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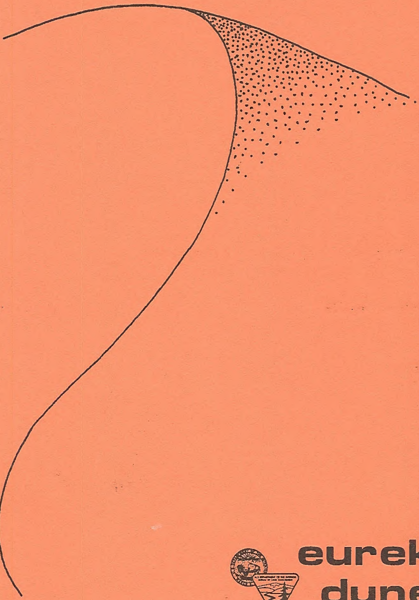

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Eureka Dunes Special Design Area
Environmental Analysis Report

Bakersfield District Office
Bureau of Land Management
Department of the Interior

July 10, 1976

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I. INTRODUCTION

In an effort to consolidate the numerous possibilities for management of the Eureka Dunes, suggestions resulting both from initial public input and from BLM personnel familiar with the dunes and surrounding area were consolidated into a list of basic management options. These were then further consolidated and organized so as to eliminate duplicate or unworkable options, or those which would have exceeded bureau authorities. This list of basic management options included the following:

1. Open the dunes to all uses, including off-road vehicles.
2. Partially open the dunes to all uses, including ORV. This suggestion included a number of division patterns for the dune system.
3. Close the dunes to all uses during certain times of the year, i.e., during the spring.
4. Restrict the use of vehicles on the dunes at night.
5. Allow only non-competitive ORV use so as to minimize conflict with other recreational use on the dunes.
6. Require a permit for all uses and establish a maximum carrying capacity.
7. Open the dunes to all recreational uses except ORV.
8. Give the dunes a special designation, such as Natural Area or Primitive Area.

These basic management options were examined and restructured so as to make workable alternatives for a management plan. These alternatives sought to combine as many of the above options as possible, while at the same time providing for a full range of management objectives.

The final range of alternatives are made up of the following:

Proposed Action: Vehicle Use, North Half (Day Only)
Alternative A: Vehicle Use
Alternative B: Vehicle Use, South Half
Alternative C: Recreation, Non-Vehicle (Outstanding Natural Area) (43 CFR 2071.1, 6292.1)
Alternative D: Off Road Vehicle Use by Permit (43 CFR 6225.0-6)
Alternative E: Research by Permit (43 CFR 6225.0-6)

II. DESCRIPTION OF THE EXISTING ENVIRONMENT

A. Non-Living Components

1. Land

a. Geology

Eureka Valley is a down-faulted desert basin surrounded by uplifted mountains. The Last Chance Mountains are to the east, the Saline Mountains are to the south, and the Inyo Mountains are to the west and north. The valley is part of the Basin and Range Province, which stretches from the Sierra Nevadas to the Colorado Plateau (Fig. 0, Regional Map, Fig. 1, Special Design Boundary).

The region has been subjected to intense faulting since an early geologic time, the Larmide Orogeny, continuing into recent geologic time. The ranges were uplifted as tilted fault blocks (Fig. 2, Geologic Map of Eureka Valley). The rugged, sparsely-vegetated, and multi-colored ranges stand out starkly from the sediment-filled valleys. Many of the valleys, including Eureka Valley, are closed basins, which in earlier geologic times were sites of large, deep, fresh water lakes. Now, with a more arid climate, these basins contain shallow ephemeral lakes. The presence of former lakes is marked by playas dry lake beds and wave-cut terraces above the level of the playas (Fig. 3, Generalized Geologic type map). Occasionally, during a wet season, the basin playas collect a thin sheet of water which soon evaporates, leaving saline deposits on the mud flats.

One such playa exists in Eureka Valley. It is two and one-half miles long by a mile wide, and lies northwest of the special design area. The presence of lake sediments (of a swelling type clay, probably bentonitic), extending from the playa to the surrounding higher elevations, is evidence of an extensive lake which once covered the valley floor.

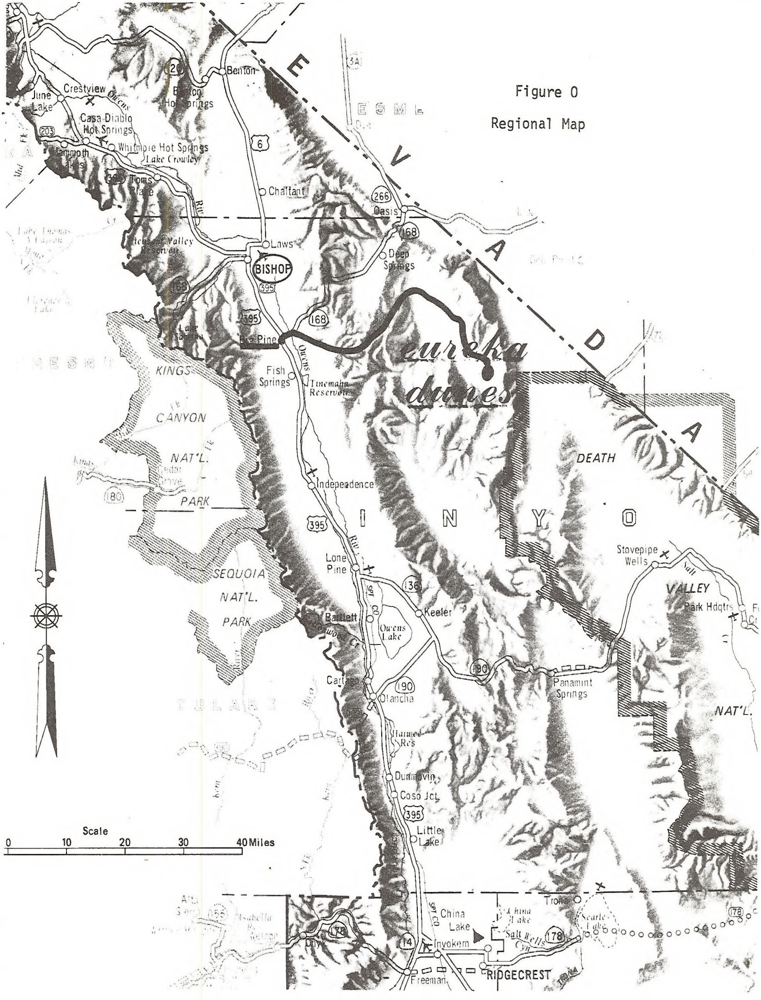
Coalescing alluvial fans originate at the canyon mouths of the surrounding range and extend to the valley floor. Erosion of the surrounding mountains and alluvial fans has gradually filled the south end of the basin with silt, sand, and gravel to a depth of over one thousand feet (Mawby, April 1975).

Several factors are necessary to build a dune formation: the presence of a source of material less than 2 mm in diameter, a recurrent wind strong enough to move the material, and a place where the material can accummulate (Hack 1941). The main sources of dune material are alluvial fans, stream deposits, and weathered outcrops of sandstone. Wind velocities of 23 mph are needed before the wind becomes visibly charged with material (Bagnold 1935). Winds of this velocity occur frequently throughout the desert, particularly in the spring. Places of sand accumulation normally include bushes, mountains, rocks, and other wind obstacles. Dunes may also form where the configuration of the mountains causes the wind to eddy, as in Eureka Valley.

Over thousands of years, the wind has swept across Eureka Valley and transported the finer sand particles to the southern end. This sand has concentrated at its present location as a result of the valley's shape

Figure 0

Regional Map



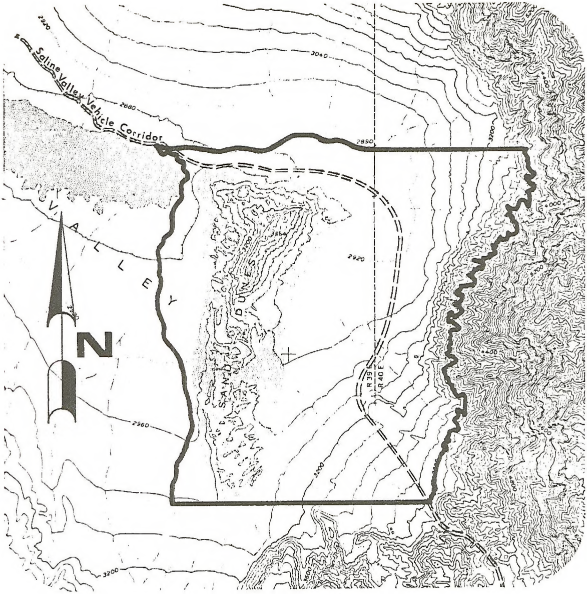


Fig. 1. Special Design Boundary

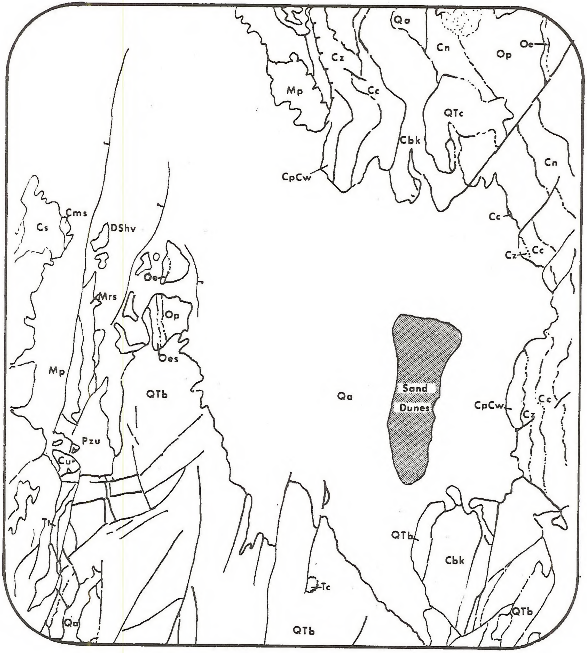


Fig. 2. Geologic Map of Eureka Valley

Sedimentary

Quaternary	Qa	Alluvial Deposits
Cambrian	Ebc	Bonanza King
Cambrian	Ec	Carrara Formation
Cambrian	Ez	Zabriskie
Precambrian	EpEw	Wood Canyon Formation

Igneous

Tertiary	Qtb	Voloanic (basalt)

Source: USDI U.S. Geological Survey Generalized Geologic Map of the Inyo Mountains Regions, California 1967.

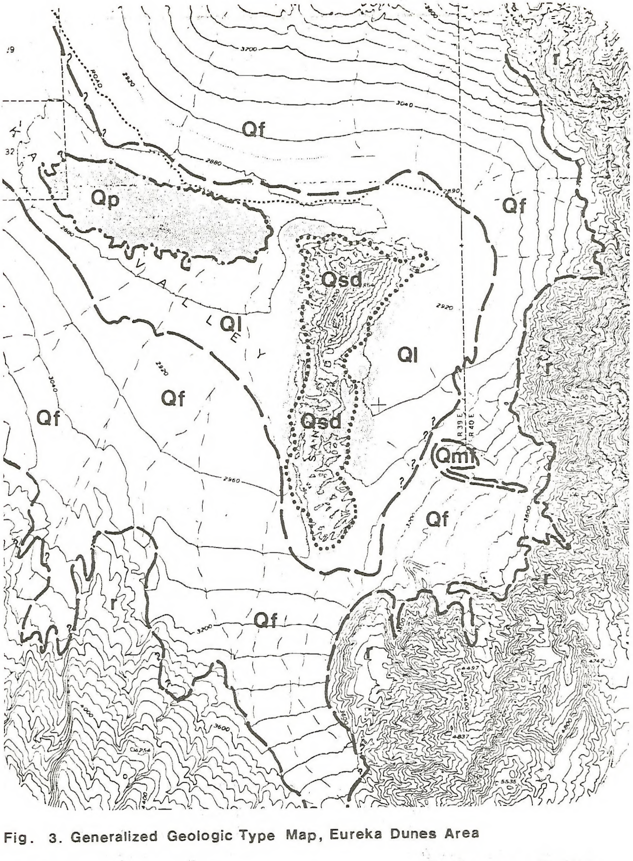


Fig. 3. Generalized Geologic Type Map, Eureka Dunes Area

Quatenary

Qsd _____ Sand Dune

Qp _____ Playa

Ql _____ Lake Bed

Qmf _____ Mudflow

Qf _____ Alluvial Deposits and Alluvial Fans

Tertiary, pre-Tertiary

r _____ Bedrock

— — — ....? Contact

(questioned where uncertain)

and the prevailing winds. North of the dunes the valley narrows to a width of about three miles, then opens into a large, circular shaped basin at the southern end of the valley. North or northwest winds, funneled through the constricted part of the valley, swirl around the southern basin and, slowed down, lose their ability to transport the sand, which then settles to form the dune accumulation.

The sand is partially stabilized, once it reaches the dunes, by moisture, vegetation and wind patterns. The overall shape of the dunes is remarkedly constant. However, the details of the dune configuration are constantly changing. The sharpness of the dune crest indicates that the dunes are active.

The dune formation is approximately a mile (2.4 km) wide by three miles (5.3 km) long by 680 feet (208 m) high. The system is a complex/longitudinal dune with long, parallel, sinuous ridges. The convex windward side has slopes of approximately 20^{o}, and the steep leeward side (or slip face) has an average slope of 33^{o}. The formation of a longitudinal dune requires a large supply of sand, strong wind velocities, and variable wind directions. The sand grains of this dune are primarily quartz with minor elements of other minerals such as magnetite, feldspar, and mica.

The age of the dunes is unknown. The sand dunes in Death Valley are thought to have formed in the last several thousand years. Because of the presence of unique species of plants and animals which have been evolving in their special habitat for at least several thousand years, it seems likely that the Eureka Dunes are much older than this. The dunes might have begun to accummulate as the climate became more arid, with the waning of the last ice age approximately 10,000 years ago. More study is needed to answer this question.

b. Soils

The processes which are important in weathering the bedrock, and in the development of soils, are somewhat similar in both humid and desert regions. Bedrock weathering and soil formation are governed by climate, types and amounts of vegetation and other living organisms present, topography, type of bedrock or parent material, and time. However, because of limited rainfall, weathering processes in deserts are mostly physical as opposed to predominantly chemical weathering in less arid climates. For this reason, the soil of the desert reflects many of the characteristics of its parent material. Desert soils usually contain low amounts of organic matter and have a low population of soil bacteria and microorganisms. Low precipitation limits leaching. Soluable salts are usually leached only to depths of one to two feet into the soil. Weak to moderate carbonate horizons form below the leached area. Carbonate accumulation or a "caliche" layer is usually formed close to the surface because limited moisure is available to move the carbonates down through the soil profile. For these reasons, desert soils are generally light-colored and sandy in texture. The low vegetative density and lack of soil moisture in the area surrounding the dunes causes the soil to be very susceptible to disturbance and erosion.

The valley fills, several hundred to a thousand or more feet deep, are of alluvial origin. There is little soil profile development. Most of the surface material was sorted and moved by water and wind before it became stabilized.

Wind erosion in the desert surrounding the dunes is of two types, deflation and abrasion. Deflation has scoured out portions of the valley and surrounding slopes. "Desert pavement" remains in the areas of deflated alluvium. Desert pavement is a layer of closely spaced rocks and gravel less than six inches wide but too large to be picked up by the wind. Desert pavement acts as a protection from further wind action. Beneath this armored surface is much finer material. If the pavement is disturbed, the wind will remove newly exposed soil down to a new layer of rock. The individual pebbles in the pavement often show abrasive wear from blowing soil. The surfaces of rocks exposed for a long time are stained black with manganese and iron oxides, called desert varnish. These oxides are thought to originate partially from dust settling on the rocks and chemically coating the rock surfaces.

In areas where desert pavement does not exist, a thin crust may form on the soil surface, through physical, chemical, and biological activity. Grains of soil may become cemented by crystallization of solutes following rains, and bound by algae, lichenuos, and fungal growth where organic matter is present (Cameron and Blank 1966; Went and Stark 1968). Algae and fungal filaments have often bound the alluvial soils into a crust in the top two to five inches of the soil profile, increasing the nitrogen content by as much as 300% and 400% (Fletcher and Martin 1948). These delicate crusts act as a lid, minimizing the erosion of the fine material beneath the surface. Considerable rain is necessary to enable algae growth to reaccummulate after it has been disturbed.

The surface of the dunes tends to stabilize as sand grains are sorted and the surface is streamlined by wind action. Fine material is blown off as dust, and the coarser grains tend to form a seal (Pond 1962). Where there are plants, fungal mycelia associated with the roots further helps to bind the sand.

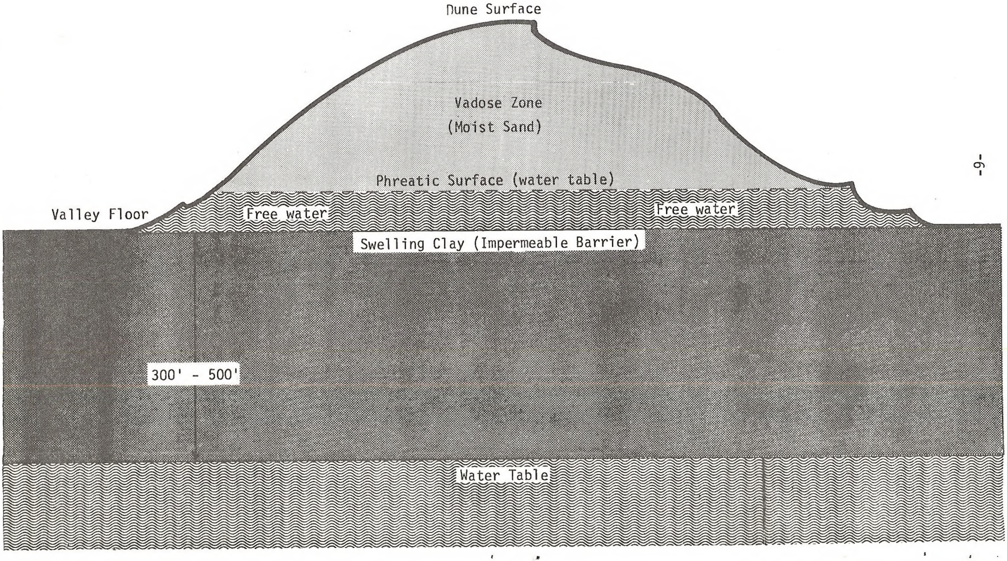
A special study of California Desert soils subjected to recreational vehicle use was performed in May, 1973 by Babcock and Sons, on ten sites throughout the desert. The criteria used for evaluation were changes in soil density, void ratio, and percolation rates of the surface horizon. From a soils-engineering standpoint, poorly sorted sands (high percentage of similar size and particles) of the dune areas showed the greatest resistance to vehicular use. Well graded soils, with a wide range of particle sizes, were the least resistant to vehicular use. A significant increase in density, and decrease in porosity and percolation capacities, caused by vehicular use were noted in the areas tested.

2. Water

a. Precipitation

Fig. 4.
SAND DUNE WATER TABLE

(Diagrammatic Cross Section)



The mean annual precipitation in the subject area is approximately six inches. Rainfall in this area varies from one extreme to the other. It is sporadic, often falling quickly over a short period of time. Most of the precipitation occurs during late winter storms, from December to March, and during late summer - early fall thunderstorms. Precipitation data for the area is sketchy.

b. Watershed

Erosion and sedimentation are active in the desert despite low precipitation. Runoff occurs into the closed Eureka Valley basin. Although the climate is arid, running water is a major erosional agent. Infiltration is minimal, consequently runoff is rapid, transporting large amounts of soil, gravel and rocks. This has resulted in large alluvial fans being built up over time. After a substantial rain, runoff collects on the playa, where it dries, forming evaporite deposits.

Eureka Valley has a perched water table located at a depth of approximately 300 to 500 feet, as indicated by old well-drilling records. The valley has a noticeable lack of springs; it is a horst (upthrust) block of impermeable granite which blocks the flow of underground water from other areas into the valley.

The dunes act as an aquifer, providing the dune ecosystem with a perpetual supply of moisture. Moisture falling on the dunes infiltrates rapidly, percolating slowly downward as gravitational water. Capillary water remains in the upper layer of the dune. Only the top few inches to a foot of sand warm in the sun and dry by evaporation. Beneath this the sand blocks the heat and prevents evaporation (Fig. 4).

East of the dunes, the thin layer of sand is underlain by the old clay lake bed. Water does not percolate far into clay. The sand over the clay prevents evaporation; thus this area has an above average supply of available soil moisture.

3. Temperature

The subject area experiences great extremes in temperature, both seasonally and diurnally. During the winter, night temperatures may drop to below freezing and the day may remain cold, or become unseasonably warm. Average winter daytime temperatures range from 55^{o}F to 60^{o}F. Nighttime temperatures commonly drop to the low 30's. Summer daytime temperatures frequently reach 100^{o}F. Nighttime temperatures vary from 60^{o}F to 70^{o}F.

Diurnal temperature variations may be as large as 50^{o}F, and seasonal variations may reach 90^{o}F. Relative humidity is low throughout the year resulting in a "dry" cold or a "dry" heat. Temperatures vary with exposure. The elevation of the subject area (3000 feet) exerts a cooling influence during all seasons (See Table 1 for temperature data on the surrounding areas).

Table 1 TEMPERATURE DATA

			Average Temp.			1973 Temp. Extremes	
Station	Elevation	Time Data Recorded	High Month Ave.	Low Month Ave.	Annual Average	High-date	Low-date
Death Valley	-194 ft.	60 yrs.	101^0 July	52^0 Jan.	76^0	124^0 7/6	24^0 1/7
Deep Springs College	5225 ft.	21 yrs.	75^0 July	33^0 Feb.	--	100^0 6/8	-10^0 1/23
Haiwee	3440 ft.	--	81^0 July	40^0 Jan.	60^0	104^0 7/5	12^0 1/7
Independence	3950 ft.	66 yrs.	81^0 July	35^0 Jan.	58^0	105^0 7/6	9^0 1/6
Trona	1716 ft.	--	89^0 July	45^0 Jan.	67^0	114^0 7/5	13^0 1/7
Wildrose Ranger Station	4100 ft.	8 yrs.	80^0 July	34^0 Jan.	58^0	102^0 7/6	11^0 1/10

Source: Climatological Data
U. S. Department of Commerce
National Oceanic and Atmospheric Administration
Environmental Data Service
California Annual Summary 1973 Vol. 77 #13

4. Air

The subject area is located within the Great Basin Air Basin, which includes the desert area north of the San Bernardino County line. This area is relatively pollution free, because the basin is located far from major population centers and is not subject to an influx of contaminated air from other basins. However, there is virtually no data on air pollution sources or ambient air quality in this basin.

There are no significant stationary pollution sources in the subject area. Some small mines contribute negligible amounts of dust pollution. One major county road traverses the area. An unimproved dirt road extends to the dunes, becoming a jeep trail beyond. There is little evidence of an air pollution problem from this source. Recreational vehicle use currently has only minor, intermittent, direct detrimental effect on the air quality. The main air pollution which occurs is from particulates which rise during strong winds. Temperature inversions during the fall-winter period affect air quality. An inversion layer prevents air from rising and holds any pollutants close to the surface.

B. Living Components

1. Flora

Desert plants can be classified on the basis of their adaptation to the aridity of the desert environment. Some plant species can survive long rainless periods. These are the true drought survivors, or xerophytes. Other species which require intermittent moisture and are not drought-resistant, are called mesophytes. Hydrophytes grow in water and phreatophytes have roots which extend down to the level of ground water.

There are three types of xerophytes. Annuals live only during times of available soil moisture, completing their life cycle within a few weeks or months. Succulents are water-storing species which use their stored water sparingly in times of drought. Non-succulents have adaptations for more efficient water utilization and conservation. Adaptations include stomatal modifications, reduced total leaf surface, waxy or hairy leaves and extensive horizonal and vertical root systems.

Seeds in the desert resist drought for many years, and remain dormant in the soil until moisture and temperature conditions are favorable for germination. Many desert plants are armed with spines or thorns which provide added protection from both drought and depredation from fauna (Chew, R.M. and A.E., 1973; Ashby 1932; and Ryon, 1974).

Most desert annuals start growth in late autumn, slow or stop growth in the winter, and produce flowers the following spring. They require daytime temperatures of 60 to 65 degrees F., and night temperatures generally above freezing, combined with winter rainfall of at least one inch. Flower production requires a long photoperiod, so the actual blooming period avoids cool, wet winter conditions. (Luckenbach, 1975). Summer annuals have extremely contracted growth periods and are often much reduced in size. They germinate in the spring and require one-half inch or more of rainfall and optimum temperatures of 80° to 90°F (Luckenbach, 1975).

The vegetation in Eureka Valley is composed of a creosote bush scrub community. A special dune association, of plants adapted to sandy substrates is located on and around the Eureka sand dunes. Many of the species in the dune association are found throughout parts of the Mojave Desert in varying relative abundancies and densities. In various locations, the exact nighes in which these plants are found vary, as does the importance of the role the plants play in the particular community. Three endemic plants that grow on the dune or near the base of the dune have been identified. They also are found at the southwest end of Eureka Valley on the shallow sand buildup near the mouth of Marble Canyon. These are as follows:

Family	Genus/Species	Common Name
Gramineae	Swallenia alexandrae	Eureka dunegrass
Onagraceae	Oenothera avita ssp. Eurekensis	Eureka Valley evening primrose
Fagaceae	Astragalus lentigonosus var. micans	Shiny locoweed

The first two of these three plants are included in the proposed Department of the Interior's "Threatened or Endangered Fauna or Flora" listing (Review of Status of Vascular Plants and Determination of "Critical Habitat"). The listing was based on a report from the Smithsonian Institution, and was published in the Federal Register, Vol. 40, No. 127, July 1, 1975, in accordance with section 12 of the Endangered Species Act of 1973. This publication was intended to alert concerned persons to seek data, advice, and relevant information, and to inform them that these plants are being considered for addition to the federal lists of the threatened or endangered species. The June 16, 1976 Federal Register Vol. 41, No. 117 contains the Proposed Endangered Status for some 1700 U. S. Vascular Plant Taxa. There will be a 90-day comment period ending August 16, 1976 after which the list will officially become part of Part 17, Subchapter B of Chapter 1, Title 50 of the Code of Federal Regulations.

Section 12 of the endangered Species Act of 1973 follows:

Public Law 93-205
93rd Congress, S. 1983
December 28, 1973

ENDANGERED PLANTS

> "Section 12. The Secretary of the Smithsonian Institution, in conjunction with other affected agencies, is authorized and directed to review (1) species of plants which are now or may become endangered or threatened and (2) methods of adequately conserving such species, and to report to Congress, within one

> year after the date of the enactment of this Act, the results of such review including recommendations for new legislation or the amendment of existing legislation."

The term "endangered species" indicates any species which is in danger of extinction throughout all or a significant portion of its range. The term "threatened species" indicates any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Eureka dunegrass and Eureka Valley evening primrose are both listed as Endangered on the Federal list. Shiny locoweed is not on the new Endangered Federal list, although it had been on the preliminary list proposed by the Smithsonian. It may appear on the Threatened list when that appears. The three endemics to the Eureka dunes are also listed and rated on the California Native Plant Society's "Inventory of Rare and Endangered Vascular Plants of California" (Fig. 5).

Eureka dunegrass, a member of the Gramineae family, is the only member in its genus. It is a coarse, stiff perennial, with running rootstocks which act tp sp,e degree, as a stabilizer for the drifting sands. The dunegrass is found throughout the dunes and extends well up the slopes. (Fig. 6).

Shiny locoweed is a member of the pea family. This gray perennial may grow as high as two or three feet and is found in medium concentrations in hollows near the base of the dunes. The major concentration is found in the area east of the dunes, at the north end, and a light concentration grows at the southeast end of the dunes. (Fig. 7).

The Eureka Valley evening primrose is the most fragile of the endemics. It grows on the lower slopes and sandy flats at the base of the dunes. The main population grows in heavy concentrations east of the north half of the dune formation. Medium and light concentrations of the plant are found east of the southern half of the dunes, around the north and south end, and along the west side (Fig. 8). This perennial has the unusual ability to grow from the tips of its old stems, a unique adaptive quality, as the old plant is often covered by drifting sand.

Other common desert plants found in or near the Special Design Area include:

1. Abronia turbinata - sand-verbena.

2. Allionia incarnata - windmills.

3. Antirrhinum kingii- least snapdragon. A delicate annual found among the mallow around the northeast corner of the dunes.

4. Astragalus sabulonum sand rattleweed.

Figure 5. California Native Plant Society Ratings

Rating	R-E-V-D
Eureka dunegrass	3-2-1-3
Eureka Valley evening primrose	3-2-2-3
Shiny locoweed	3-2-1-3

Rarity (R)

1. Rare, or limited distribution, but distributed widely enough that potential for extinction or extirpation is apparently low at present.
2. Occurrence confined to several populations or one extended population.
3. Occurs in such small numbers that it is seldom reported; or occurs in one or very few highly restricted populations.

P. E. Possibly extinct or extirpated.

Endangerment (E)

1. Not endangered.
2. Endangered in part.
3. Totally endangered.

Vigor (V)

1. Stable or increasing.
2. Declining.
3. Approaching extinctin or extirpation.

General Distribution (D)

1. Not rare outside California.
2. Rare outside California.
3. Endemic to California.

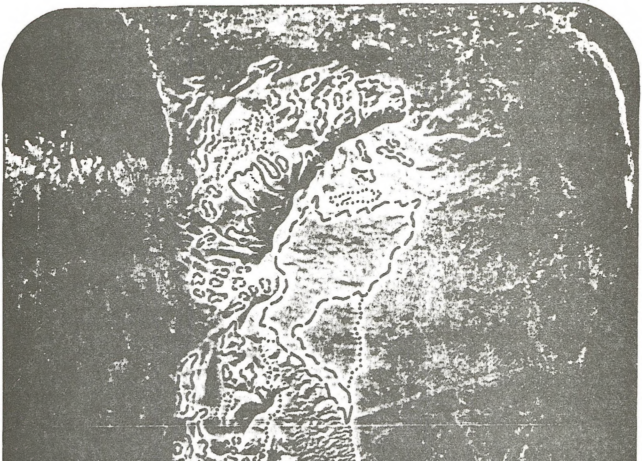


Fig. 6. Distribution of Eureka dunegrass (Swallenia alexandrae)

CONCENTRATIONS
light ....
medium — — — — —
heavy ————————

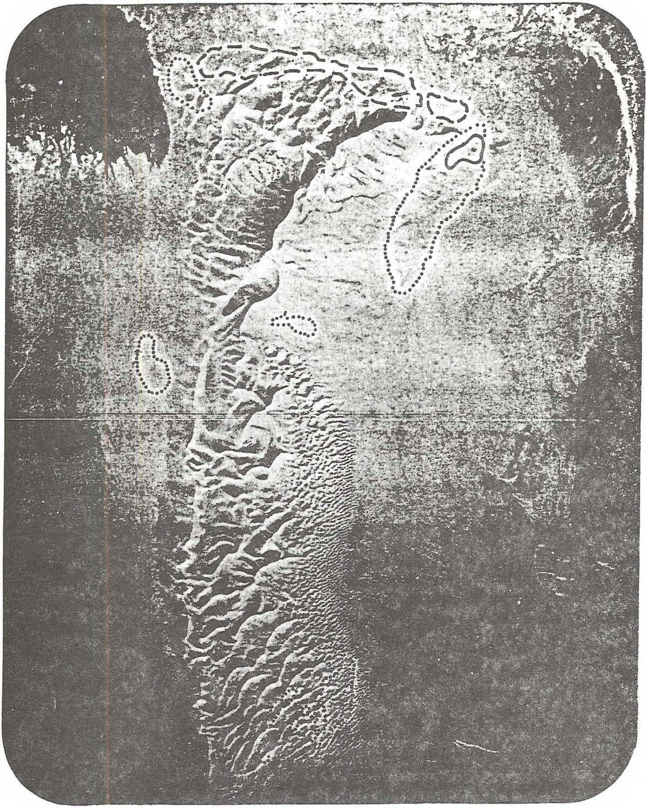


Fig. 7. Distribution of shiny locoweed (Astragalus lentiginosus var micans)

CONCENTRATIONS
light ....
medium — — — — —
heavy ————————

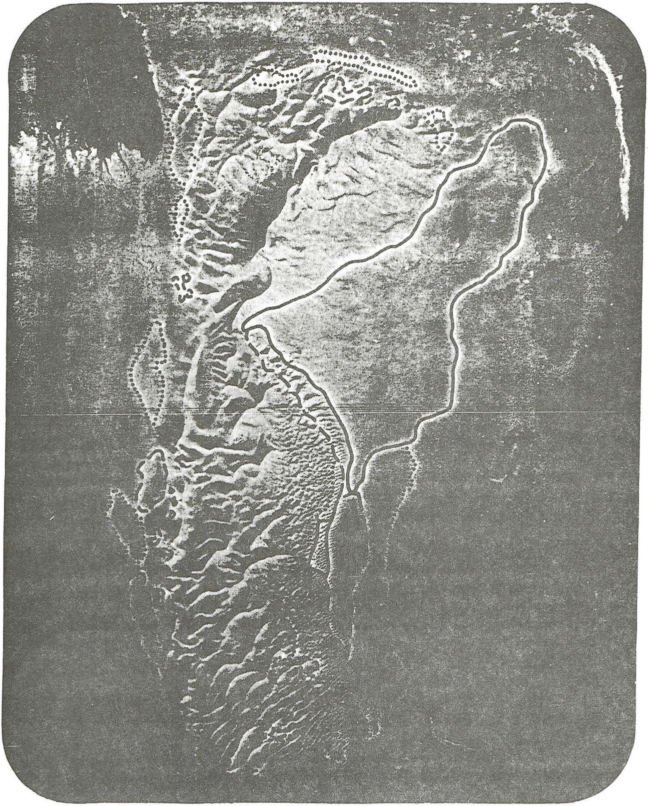


Fig. 8. Distribution of Eureka Valley evening primrose (*Oenothera avita* ssp *eurekensis*)

CONCENTRATIONS
light ....
medium — — — — —
heavy ————————

5. Atrichoseris platyphylla - gravel ghost. One of the Death Valley species which occurs near but not on the dunes.

6. Atriplex canescens - four-wing saltbush.

7. Atriplex confertifolia - shadscale.

8. Atriplex polycarpa - allscale. The dominant shrub over much of the area bordering the dunes ascending to the fans where it meets creosote bush.

9. Atriplex truncata - wedgescale.

10. Baileya pleniradiata - woolly marigold.

11. Blepharidachne kingii - king's eyelash grass.

12. Bouteloua barbata - six-week grama.

13. Camissonia claviformis ssp. funerea - brown-eyed primrose, common.

14. Chaenactis carphoclinia - pebble pincushion. A common species in creosote bush scrub community.

15. Chaetadelphia wheeleri - May reach its southern limit in Eureka Valley.

16. Chorizanthe rigida - rosy thorn, common.

17. Cleome sparsifolia - spiderwort.

18. Coldenia plicata - small perennial common on lower slopes and sandy flats. Long thread-like root, anchored by deeply buried capsule allows movement with wind blown sand.

19. Dalea polyadenia - dotted dalea, common.

20. Dicoria canescens ssp. clarkae - clark's dicoria. A composite late autumn maturing annual.

21. Eriogonum insigne - buckwheat.

22. Eriogonum reniforme - kidney-leaved buckwheat.

23. Euphorbia micromera - desert sand mat.

24. Euphorbia ocellata var. arenicola - yellow-flowered spurge.

25. Hymenoclea salsola - cheese bush.

26. Larrea tridentata - creosote bush. Dominant shrub descending the fans on the east side of the special design area.

27. Lupinus shockleyi - shockley lupine. A small rather uncommon annual of sandy areas.

28. Nama demissum - purple mat.

29. Oryzopsis hymenoides - Indian rice grass. Found throughout the area. An almost pure stand, forty acres of more is located on the east side of the dunes.

30. Palafoxia arida - Spanish needle.

31. Pectis papposa - chinch-weed.

32. Salsola paulsenii - barbwire russian thistle.

33. Sphaeralcea ambigua - Apricot mallow. Best developed along the east side of dunes.

34. Stanleya pinnata ssp. inyoensis - Inyo desert plume. Type locality is the northeast end of the dunes. (First recorded discovery of this subspecies).

35. Stephanomeria pauciflora - Desert straw.

Within any community there are instances or factors which cause vulnerability in generally damage-resistant communities, or factors which lend resistance to normally vulnerable communties. These factors have been considered in the following site evaluation. Criteria used for evaluating potential damage to the vegetation resource by recreation vehicle use includes the following:

1. Vulnerability of plant species according to growth form, distribution, density and/or armament, and probability for revegetation.

2. Vulnerability of individual sites according to terrain, location, accessibility and/or attractiveness to people.

3. Presence of rare, endangered or unique plant species.

4. Importance of plant species or plant communities to the rest of the local ecosystem.

5. Tendency of vehicle operators to avoid natural obstacles which might damage person or vehicle.

Using these criteria, we evaluate the plant communities of the areas as follows:

Plant Community	Percent of Desert Represented	Vulnerability to Vehicle Use
Creosote Bush Scrub	60	Low generally
Shadscale Scrub	1±	Low generally
Desert Grassland	less than 1	High
Desert Wash	1±	Low

2. Fauna

The desert area supports a wide variety of wildlife species. Generally speaking, animal population dynamics are the same, in principle, in desert populations as in any animal population. There are, however, centain unique adaptative qualities that are present in desert populations.

The harsh climate imposes limitations on the types of fauna able to inhabit the area. Certain species are more suited than others to coping with limited water, often limited food, and high summer and low winter temperatures. There are few large herbivores or carnivores as large mammals need great amounts of water for evaporative cooling during summer heat. Vegetation is often sparse, limiting browsers to those which are general in dietary needs. Rodent, reptile and bird populations make up the bulk of the vertebrate biomass. These small species escape the heat by burrowing or seeking shade in low shrubs. This reduces the need for evaporative water. Some species can obtain most of their water needs from food. Birds often migrate to escape the extreme summer heat. Reptilian species are dependent on high ambient temperatures to remain active. During the summer they generally avoid midday sun; many are nocturnal. Snakes and lizards generally hibernate during the colder periods of winter.

Desert populations are mainly cyclic, remaining at a low subsistence level during periods of stress, then responding to optimum environmental conditions. The amount of biomass of animals per acre in the desert is low compared with other areas, because of environmental conditions such as limited amounts of food, water, and cover.

Many species of birds inhabit the desert as migrants and as residents. But, bird populations are limited by the lack of abundant food and free water.

Adaptation, both physical and behavioral, is the key to desert survival. The environment requires species to utilize adaptative qualities that enable them to cope with the harsh climate and adverse habitat conditions. Some adaptations include nocturnality summer or diurnal periods of estivation, burrowing, physiological adaptations, and restriction to micro-habitats (ICMP Environmental Analysis, 1973).

Most animal activity is nocturnal, and thus goes unnoticed by casual observers. There are, however, numerous animal species which inhabit the Special Design Area. These includes:

Birds

Turkey vulture (*Cathartes aura*) migrant.

Swainsons hawk (*Buteo swainsoni*) migrant.

Red-tailed hawk (*Buteo jamaicensis*) permanent resident, nests in Last Chance Mountains.

Prairie falcon (*Falco mexicanus*) permanent resident, nests in Last Chance Mountains.

Golden eagle (*Aquila chrysaetos*) permanent resident, may nest in Last Chance Mountains.

American kestrel (*Falco sparverius*) permanent resident

Burrowing owl (*Speotyto cunicularia*) hypothetical occurrence.

Great horned owl (*Bubo virginianus*) permanent resident, nests in Last Chance Mountains.

Mourning dove (*Zenaida macroura*) migrant.

White-throated swift (*Aeronautes saxatalis*) nests in Last Change Mountains.

Say's phoebe (*Sayornis saya*) permanent resident, breeds in area.

Ash-throated flycatcher (*Myiarchus cinerascens*) breeds.

Horned lark (*Eremophila alpestris*) permanent resident, nests near dunes.

Violet-green swallow (*Tachycineta thalassina*) may nest in Last Chance Range

Common raven (*Corvus corax*) permanent resident, nests in Last Chance Mountains.

Rock wren (*Salpinctes obsoletus*) permanent resident, breeds.

Mockingbird (*Mimus polyglottas*) breeds near dunes.

Le Conte's thrasher (*Toxostoma lecontei*) may breed near dunes.

Phainopepla (*Phainopepla nitens*) may breed near dunes.

Loggerhead shrike (Lanius ludovicianus) permanent resident, probably breeds near dunes.

Starling (Sturnus vulgaris) migrant.

Black-throated gray warbler (Dendroica nigrescens) migrant.

Wilsons warbler (Wilsonia pusilla) migrant.

Yellow warbler (Dendroica petechia)

House finch (Carpodacus mexicanus) permanent resident, probably breeds near dunes.

Brewer's sparrow (Spizella breweri) migrant.

Savannah sparrow (Passercules sandwichensis) migrant.

Black-throated sparrow (Amphispiza bilineata) summer resident, breeds near dunes.

Sage sparrow (Amphispiza belli) winter - migrant.

White-crowned sparrow (Zonotrichia leucophrys) winter resident.

The preceeding list of birds use the dune area to some extent during their life cycles.

On occasions (e.g., the fall of 1975) an especially heavy rainstorm partially fills the dry lake area west of the dunes. During these periods, various water birds have been observed in or would be expected to utilize, this area, especially in the spring and fall months. These are:

Pintail (Anas acuta) and other water fowl

Killdeer (Charadrius vociferus)

American avocet (Recurvirostra americana)

Wilson's phalarope (Steganopus tricolor)

Spotted sandpiper (Actitis macularia)

Least sandpiper (Erolia minutilla) and possibly several other species of shorebirds.

Reptiles

Desert iguana (Dipsosaurus dorsalis dorsalis) sandy plains, creosote flats sand hummocks, lays eggs underground June - August hatch August, September burrows 2 inches to 2 feet in sand.

Collared lizard (*Crotophytus collaris baileyi*) rocky habitat - east side of special design area.

Long-nosed leopard lizard (*Crotophytus wislizenii wislizenii*) playa edges, dune edges, scattered shrubs - eat lizards, insects, lay eggs July-August, hatch August, September diurnal.

Zebra-tailed lizard (*Callisaurus draconoides rhodosticus*) loose sand - diurnal, sometimes nocturnal, morning and evenings.

Side-blotched lizard (*Uta stansburiana*) all soil types, diurnal lay eggs July, hatch August.

Northern Desert-horned lizard (*Phrynosoma platyrhinos calidiarum*) sandy soil ow shallowly, diurnal, lay eggs July - hatch August.

Desert Banded gecko (*Coleonyx variegates variegatus*) hypothetical occurrence rocky habitat, frequents sandy flats, lays eggs - hatch fall

Western whiptail (*Cnemidophorus tigris*) vegetated fine soils - diurnal eggs hatch July, August.

Nevada shovel-nosed snake (*Chionactis occipitalis talpina*) hypothetical occurrence playa, sand - predommantely nocturnal, peak activity May-June rapid burrower, nasal valves, countersunk jaws, burrows 2 inches to 2 feet, eats insects.

Common Whipsnake (*Masticophis flagillum piceus*) hypothetical

Spotted nigret snake (*Nypsiglena torquata deserticola*) hypothetical.

Great Basin gopher snake (*Pituophis melanoleucus deserticola*) Not on dune - active 24 hours. Eggs hatch September, October.

Panamint rattlesnake (*Crotalus mitchelli stephensi*) hypothetical occurence rock dweller - occasional in sand-commonly nocturnal, diurnal spring, fall

Sidewinder (*Crotalus cerastes*) playa, dunes, nocturnal plus dusk and cool days bury coiled just under surface birth of young September, October.

Mammals

Desert kit fox (*Vulpes macrotis arsipus*)

Desert coyote (*Canis latrans estor*)

Desert bobcat (*Lynx rufus baileyi*)

Desert antelope ground squirrel (*Ammospermophilus leucurus leucurus*) (does not estivate).

Pocket gopher (*Thomomys bottae melanotus*)

Utah long-tailed pocket mouse (*Perognathus formosus formosus*)

Silky Pocket mouse (*Perognathus longimembris*)

Merriam's kangaroo rat (*Dipodomys merriami merriami*)

Desert kangaroo rat (*Dipodomys deserti deserti*) restricted to wind blown sand habitat.

Pallid kangaroo mouse (*Microdipodops pallidus*) southern limit of known range

Southern grasshopper mouse (*Onychomys torridus longicaudus*)

Cactus mouse (*Peromyscus eremicus*)

Desert woodrat (*Neotoma lepida lepida*)

Desert jack rabbit (*Lepus californicus deserticola*)

Desert bighorn (*Ovis canadensis nelsoni*) ordinarily confined to the Last Chance Mountains, however individuals may rarely wander near the dunes.

1. Hypothetical (Ingles 1970)
2. Hypothetical (Hall and Kelson 1959)
3. Confirmed from Death Valley, Saline Valley, Deep Springs or Owens Valley and possibly occuring in Eureka Valley.

1,2 Little brown bat (*Myotis lucifugus*)

1,2,3 Yuma Myotis (*Myotis yumanensis*)

1,2,3 Long-eared Myotis (*Myotis evotis*)

1,2 Fringed Myotis (*Myotis thysanodes*)

1,2,3 Long-legged Myotis (*Myotis volans*)

1,2,3 California Myotis (*Myotis californicus*)

1,2,3 Small footed Myotis (*Myotis subulatus*)

1,2,3 Silver-haired bat (*Lasionycteris noctivagans*)

1,2,3 Western Pipestrelle (*Pipistrellus hesperus*)

1,2,3	Big brown bat (*Eptesicus fuscus*)
2	Red bat (*Lasiurus borealis*)
2,3	Hoary bat (*Lasiurus cinereus*)
2	Spotted bat (*Euderma maculata*)
2	Lump-nosed bat (*Plecotus townsendi*)
1,2,3	Pallid bat (*Antrozous pallidus*)
1,2,3	Brazilian free-tailed bat (*Tadarida brasiliensis*)

A species of fairy shrimp, *Branchinecta sp.*, is found in the playa west of the dunes when water is present after summer rainstorms. The shrimp are about one inch in length. Eggs are laid in a pool of water and when it evaporates, the eggs dry up and become encysted. When environmental factors are right, e.g. salinity of water, amount of available oxygen, and temperature, the eggs hatch, and quickly mature into adult shrimp. Several species of birds probably feed on these shrimp.

There are several species of insects on these dunes which have adopted highly specialized characteristics, over countless years of isolation from other sand insects. They have lost their ability to fly, and are larger than their nearest relatives living under more moderate conditions. Four species are endemic to the dunes. Their life histories, presently unknown, are being studied by insect specialists.

The following *Coleoptera* occur at the dunes: (The first four are endemics)

1. *Cardiophorus* n. sp. all species of this large genus are restricted to sand dunes or sandy soil: Predatory larvae.

2. *Horistonotus* n. sp. - similar to *Cardiophorus*. Only a single species previously known from California.

3. *Aegialia* n. sp. - nearly all restricted to sand substrates; many species.

4. *Miloderes nelsoni* - fairly widespread on dunes within Great Basin, possibly occurring as far south as Kelso Dunes.

5. *Lariversius tibialis* - similar distribution to above.

6. *Trogloderus costatus* - widespread, but greatly differentiated locally. Taxonomy needs to be reevaluated.

7. *Eusattus muricatus* - widespread on interior dunes. Many locally differentiated populations.

8. Edrotes ventricosus - taxonomy confused. Much local endemism exists, and Eureka Valley may support a distinct race or subspecies.

(correspondence with Derham Giuliani, local entomologist, and John T. Dayen, Assistant professor of Entomology, University of California, Berkeley, 1976.)

C. Ecological Interrelationships

1. Limiting Factors

Biological productivity at any given time may be limited by a single factor. For instance, if the soil contains excessive salts, plants may not be able to fully utilize nitrates. Utilization of nutrients by plants may be limited by available soil moisture. Animal production may be limited by this since many desert animals obtain their moisture from vegetation. Factors limiting productivity may change over time. If, in the ecosystem considered above, a prolonged period of rainfall occurs, harmful salts may be leached deep into the soil, resulting in less restriction to plants. Then nitrates or other nutrients may become a limiting factor. The nature of limiting factors must be known, in order to adequately assess the impacts of different uses (ICMP Environmental Analysis 1973).

The major factor limiting the ecosystem in Eureka Valley is the effect of irregular and low precipitation combined with high evaporation potentials. This results in limited available soil moisture for flora, and limited water for fauna. The period of soil moisture utilization is the period of primary production for the community and determines the supply of food available to consumers and decomposers for the entire annual cycle (Odum, 1971, Fig. 9).

Factors influencing available soil moisture are topographic postion, soil texture, and soil salinity. Higher slopes on alluvial fans and canyon floors receive most of the runoff from surrounding hillsides, resulting in a higher diversity and abundance of flora and fauna here than on the valley floor.

Fauna species in an area are determined in part by vegetation, soils, topography, climate, and water sources. As an example, the lack of trees over Eureka Valley eliminates tree-dwelling birds and rodents as possibilities in the faunal system. The sand dunes make possible the existence of specialized dune populations of insects, reptiles and other species. Faunal populations that need free water can range no farther than they can travel from open surface water.

2. Interdependence

The biota of the desert is interwoven; each organism of the web is dependent upon many other organisms. At the base is the vegetation, (see Food Web) which depends in part upon precipitation, soil characteristics and sunlight. The vitality and productivity of the vegetation

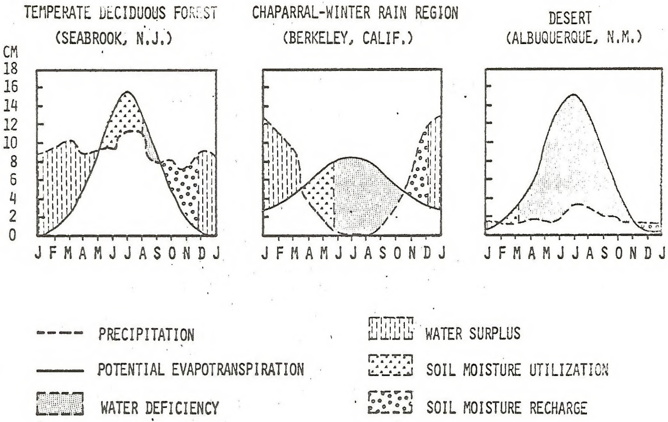
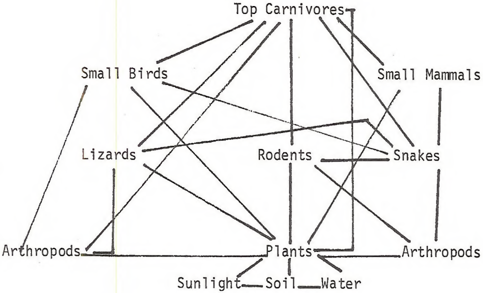


FIGURE 9 : RELATIONSHIP BETWEEN RAINFALL AND POTENTIAL EVAPOTRANSPIRATION (EVAPORATION FROM SOIL PLUS TRANSPIRATION FROM VEGETATION) IN THREE LOCALITIES REPRESENTING THREE DISTINCTLY DIFFERENT ECOLOGICAL REGIONS. THE DOTTED AREA IN THE CHARTS ("WATER DEFICIENCY") INDICATES THE SEASON DURING WHICH WATER MAY BE EXPECTED TO BE A LIMITING FACTOR, WHEREAS THE VERTICAL EXTENT OF THIS AREA INDICATES THE RELATIVE SEVERITY OF THIS LIMITATION. (AFTER THORNTHWAITE, 1955.)

From: Odum, Eugene P., Fundamentals of Ecology; third edition,
(Saunders Co., Philadelphia, 1971)

influences the productivity of the dependent fauna and insect species. In years of sufficient rainfall, shrubs and annuals greatly increase production of seeds and vegetative mass: With an increase in food sources and with sufficient water, primary consumers increase. With the increase in primary consumers, there follows an increase in secondary or predator species after varying time lags.

Food Web



Vegetation provides food sources and protective, cooling cover for burrow entrances, nest sites and resting areas. Most rodent and reptile burrows are located beneath shrubs. Small birds nest within or beneath shrubs and trees. In turn, some species of flora depend upon insects and birds for pollination; specific plant - insect interdependencies are often found. Root mycorrhizae, mycelia of fungi which live in mutualistic association with plant roots, are present on the roots of desert plants, as in other communities (Odum, 1971). These result in a large increase in the mineral consumption of the plant.

3. Competition

Because floral and faunal species in the Eureka dunes are more numerous than would be expected in an arid habitat, there is competition among the various species for water, nutrients, shelter and space. Most niches are occupied. When certain populations become relatively abundant, other populations occupying similar niches may be out-competed and forced to emigrate or suffer population losses.

4. Succession

Every ecosystem begins the successionary cycle with few plants and animals, contains some unused niches, and is highly susceptible to disturbance since food relationships are generally simple and linear, with few potential substitutions. As the ecosystem evolves, it gains a greater diversity of organisms, with more complex interrelationships. Ecosystems trend toward a climax stage with much energy expenditure directed toward maintenance of the community rather than toward growth and successional change. When an ecosystem is disturbed, it is set back in succession to an earlier developmental stage. Baseline data is lacking, but because of the loose sandy substrate, the dune ecosystem is not thought to have been highly diverse or complex, even prior to vehicular use of the dune.

When a desert plant community is disturbed, the plants that ultimately return are usually the offspring of the original species. Some invasion may occur by less valued species. The first species to become established on a disturbed area are often non-native forbs, which may be of little value to the existing consumers. Plant successions are governed by the ability of the different plants to seed and to germinate in the particular environment. In the case of the dunes, probably only plants adapted to sand currently found on and around the dunes would become re-established.

Desert plant communities are normally closed communities of widely spaced shrubs, with a generally sparse, ephemeral understory of grasses and forbs. Above normal rainfall periodically allows an increase in herbaceous plant production. Because of the competition for moisture rather than light, growth forms are low and shrubby. Plants are widely spaced to allow room for the large root systems. Allelopathic or growth retarding substances are released by some species with the effect of inhibiting other plants from rooting nearby. Large root systems and allelopathy may prevent injurious competition for water which would result in small, unhealthy, stunted plants that might not survive excessively dry years.

When comparing the characteristics of climax or mature stages on non-extreme soil types, as contrasted with seral or developmental stages of ecosystems, the following statements can be made:

> Mature stages require very little energy to remain in equilibrium.
>
> Mineral cycles are basically closed and the nutrient exchange rate between organisms and environment is low, so nutrient conservation is higher.
>
> Internal symbiosis is more developed, leading to higher stability. High stability implies resistance of the system to external impacts.
>
> Diversity of species is high and the area is likely to be of greater visual and interpretive interest. (Environmental Analysis ICMP, 1973).

The dunes are a special ecosystem in which the first three statements apply, but less strictly because the substrate is extreme.

5. Nutrient Cycles

Cycles of nutrient exchange are not well understood in the desert. The components are known, since they are similar to those encountered elsewhere, but it is not presently possible to establish quantitative comparisons of nutrient exchange in various ecological communities.

The detritus food web breaks down organic matter from dead organisms which otherwise cannot be used directly by higher plants. Through decomposition by microorganisms, organic matter is converted to available nutrients. Ammonification and nitrification are processes, occurring during decomposition, which convert organic nitrogen compounds into forms that can be utilized by green plants. Some bacteria can capture free nitrogen from the air and make it available to plants. The two groups of nitrifying bacteria, symbiotic and non-symbiotic, each include several species. Non-symbiotic bacteria include both aerobic and anaerobic species (Environmental Analysis ICMP, 1973).

6. Dune Ecology

The dune complex supports a unique ecosystem which is tied to the rest of the valley. Insects, seeds, and other organic matter are blown into the dune complex, where they collect on the sand in wind eddies. Colonies of ants and other arthropods in the central parts of the dunes are heavily dependent upon this debris. Lizards feed upon the ants, beetles, and various insects. Snakes and birds consume the lizards. Kangaroo rats live on the dunes and feed on seeds and plants. Plants growing in the bowls and gentle slopes offer habitat and food to many of the dune dwellers. A couple of the important food plants for animals are desert dicoria and indian ricegrass. The dune grass offers essential subsurface stabilizing forces which allow desert kangaroo rats to establish burrows beneath the dune grass hummocks.

Most dune dwellers are highly dependent upon the sand for cover. They either construct tenuous burrows in the loose substrate, mostly near vegetation, or submerge themselves to various levels. The desert kangaroo rat utilizes burrows in several ways. They conserve body moisture by remaining in the cool moist burrow and store dry seeds there. The seeds collect moisture from the air, thus lessening the need for additional sources of moisture for this non-drinking creature. Lizards and snakes bury themselves from two inches to two feet beneath the surface, when non-active.

Activity patterns range from nocturnal to duirnal, with a variety of abilities to estivate during cold or hot weather. Generally, snakes, geckos, and rodents are nocturnal. Predators feeding on these are also nocturnal. The desert iquana and other lizards are diurnal, often even showing activity during the heat of the day. Various non-dune dwellers come to the dunes to exploit the resources. These include passerine birds, ravens, prairie falcons and other raptors, kit foxes, coyotes and various other primary and secondary consumers (letter to Neil Pfulb from the staff of the U. C. Berkeley Museum of Vertebrate Zoology, September 25, 1973).

The populations of the endemic Eureka Valley evening primrose and the endemic locoweed that surround the dunes are part of the dune ecosystem intergradation into the alluvial fan ecosystems. They are important to the creatures that play a part in the ecosystem.

Ecologically, the Eureka sand dunes are important, because here evolutionary processes have occurred over thousands of years in a localized area with specific boundaries and specialized habitat requirements. These processes have perhaps been intensified, because the genepools are not extremely large and because the habitat restrictions are so stringent. Small genepools concentrate genetic differences and bring about a higher mutation rate. Harsh habitats require specific adaptive qualities in an organism. The result has been a community of highly specialized and unique flora and fauna dwelling on the dunes.

Some dune plants have developed stems that grow in spiral form, twisted by the entire plant revolving in response to wind. Others plant adaptions have occurred in response to slow covering by wind-blown sand. The Eureka dune grass grows at the tips of its stems when the rest of the plant is covered. The Eureka Valley evening primrose roots at the nodes when they are covered, and grows at the tips as well.

The fauna also has adapted to life on the windy dunes. Most notable in adaptation are the flightless insects and beetles. The characteristic of flightlessness helps prevent the insects from being blown off the dunes by the persistent winds. Another adaptation to the environment is seen in the shovel-nosed snake, which has special eyelids and nostril orifices and a countersunk jaw to prevent sand intrusion as it burrows in the sand.

Evolution is inherently a very slow process. It consists of a series of mutations (changes) on phenotypic (appearance) and genotypic (genetic composition) levels. The phenotype (appearance) of a plant may change in response to new environmental conditions; i.e. less water results in smaller leaves and shorter stature. Should conditions change back to the original, the plant will reassume the original phenotype unless long periods of time has passed. Over large regions a specific plant or animal may have variable phenotypes, but still have the same genotype, enabling the individuals to interbreed. If a population is isolated for a sufficient time period the genotype may eventually change as a result of non-destructive mutations, and the plant may become a separate species specifically adapted to its particular environment. Rapid changes in habitat, especially for highly specialized species, may fail to elicit an adaptive response and thus, the potential for extinction rather than evolution exists.

IV. HUMAN VALUES

1. Landscape Character

Human values focus on those environmental aspects having value only as perceived by humans. Landscape types are the result of natural processes and human cultural processes. Human cultural processes include any of man's alterations to the land that change its character.

Man perceives his environment through his five senses: sight, sound, smell, taste, and touch. The visual character of a landscape is the overall impression created by a combination of perceivable features, or landscape elements. These elements are perceived in terms of form, line, color, and texture.

Landscapes possessing a greater degree of visual variety are more desirable than those that tend towards monotony or sameness. The more elements present in the landscape which exert a strong visual influence or contrast, the stronger or more interesting the landscape character.

An examination of the Eureka Dunes Special Design Area shows it to posses the basic elements as follows:

Form - The dominant form is the majestic towering dune mass. Overlooking the dunes from a greater height to the east is the darker, imposing shape of the Last Chance Range.

Line - Those lines found within the subject area which influence landscape character, are a result of abrupt contrast in color (the multi layer striations in the Last Change Range) and form (the base and ridge of the dune and the skyline over the mountain ranges).

Color - Color varies with time of day, with time of year, and with weather. The element of color is usually most prominent in the vegetation, especially in the spring of a year with sufficent rainfall. Displays of an astonishing variety of color and beauty are expressed in a carpet of wildflowers in such years.

However, the predominate expression of color in the area is in the soil and rocks. The contrast from the dull brown of the valley, to the bright whitish-gray of the dunes, to the dark grey-black of the mountain ranges, to the luminous blue sky ultimately expresses color as an important element of the landscape character. A closer examination shows a detailed variation of light and dark colors within the layers of the Last Chance Range. Also, dark streaks show on the light dune surface.

Texture - While vegetative patterns usually give landscape its predominate texture, vegetation is sparse in the desert. The desert shrubs give the valley and alluvial fans a wooless texture. Erosive patterns have worn the mountains into a harsh and rugged texture. The sand dunes have a soft, smooth texture as a result of uniformly shaped and sized sand particles.

Perception of these basic elements varies with distance, angle of observation, time of day, scale, season, and light.

The quality of the landscape is dependent upon how each feature supports the overall theme. Natural processes within the subject area result in a landscape type in which the various parts (biologic, geologic and climatic) build toward three dominant themes. The dominant themes of the subject area are those of open space, solitude and natural beauty.

A harmonious landscape has integrity and is devoid of incongruous elements. The more unity and harmony, the more complete the pleasure of the observer.

Accentuating features characterized by their dominance, add to the quality of the landscape as long as they retain a sense of harmony or unity. The dune mass is one such accentuating element of the landscape.

There are few human cultural processes, such as mining or ranching, within the subject area. The predominate human cultural process present is an ephemeral one, recreation. Recreational activities include camping, sightseeing, hiking, picnicking, photography, hang gliding, O.R.V. use, sand skiing, sand play, golf, nature study, painting, rock hounding, and relaxation. (See Appendix A for vehicle counts, points of origin, and analysis of use).

These human cultural processes affect the harmonious element or general theme of the landscape character in various degrees. The greater the alteration, be it visual, aural, tactite, or related to odor or to taste, the greater the intrusion on the landscape's character. Intrusions vary from that of sounds of machines, to those of intense camper use.

2. Socio-Cultural Interests

Socio-cultural attractions within the subject area range from archaeological sites, to the leisure pastimes one may pursue in the area, which include such activities as dune buggy driving and hang gliding.

a. Educational-Scientific

There are numerous resources within the subject area which have contributed in the past, and which have future potential of contributing, to scientific knowledge, and to the understanding of historical and environmental interrelationships and natural processes. These resources include geological, ecological, archaeological, hydrological, historical and climatological elements. Very little study, beyond identification of the values present, has been completed within the subject area. The majority of these elements are, at present, unknown to the general public, or if known, little disturbed. However, some vandalism, collecting and ecological deterioration has occurred. No permanent developments exist within the subject area exclusive of unimproved roads.

b. Cultural Values

In some areas of the country the values of historic places, objects, and structures are important to the present day activities of subcultures. Such areas are important and of value, not because of public educational or historic interest, but because they are vital to the preservation of a subculture.

The archaeological sites within the subject area have value for public education and historic interest but are not vital to the present day activities of any subculture. Many of these sites have been disturbed through collecting and other human activities. Numerous sites lie adjacent to or outside of the Special Design boundary.

1. Ethnographic Background

The study area was historically occupied by the Western Shoshoni, who also occupied the northern halves of Death Valley and Panamint Valley, all of Saline Valley, the southern shore of Owens Lake, the Koso Mountains (Coso Range), the northern edge of the Mojave desert, and the eastern slope of the Sierra Nevada Mountains (Steward, 1938:71). Their neighbors to the north and east were the Paiutes and, to the south, the Tubatulabal and Kawaiisu.

The basic social and economic unit of the Shoshoni was the family. Families aggregated for communal rabbit and antelope drives. They also lived in communal villages in the winter. Plant collecting was the main subsistence pattern, with hunting carried on as an adjunct. Women did most of the collecting while men hunted large animals such as deer and mountain sheep. Both sexes hunted small game, including rodents and lizards.

According to one informant (Steward, 1938:72) pine nuts were the most important food source. These were collected in the fall and stored for use throughout the winter. Small quantities were transported to winter villages which were usually located near the mouths of canyons, at the base of the mountains. One winter village was reported by Steward (1938:79) as probably being located at Waucoba Spring. This was probably the main village of the Western Shoshoni group that occupied the territory between Saline and Eureka Valleys.

When the supply of stored food was exhausted, about March or April, families left the winter villages to procure vegetal food. They also hunted rabbits and antelope. This may have been the time of year at which they went to Eureka Valley. Steward reports (1938:79) that the valley contained important quantities of "sand grass" (Oryzopsis) and another unidentified grass (maybe the dune grass). He states that "water was obtained from a well near the sand dunes." Summer was spent gathering seeds as they became available in the mountains. In the fall, communal rabbit hunts were held and the pine nut harvest began.

The above is an idealized seasonal round. Resources were highly variable in density and abundance from year to year. Communal activities could only occur in years when the food resources could support aggregations.

Property ownership was limited to the products of one's own labors. Natural resources were free to anyone. "Women owned their baskets, clothes, and other objects used by them, while men owned hunting equipment and things peculiar to their sex. The household owned the house, foods and general equipment (Steward, 1938:253)." Large game was the only exception. The hunter could keep the skin and some choice part, but the rest was shared with other members of his village.

There were two types of leaders - one acted as a rabbit drive director and the other presided over festivals (Steward 1938:76).

In summary, the Western Shoshoni pursued a hunting and gathering existence where plant collecting was of primary importance. The basic socio-economic unit was the family. Families aggregated together for communal activities when resources permitted.

2. Prehistoric Background

The following summary of Great Basin archaeology was taken from Hall and Barker (1975).

A pre-projectile point culture has been hypothesized for the Great Basin. However, at the present time this is not well-documented nor generally accepted by the archaeological community. From 10,000 B.C. to 6,000 B.C. cultural activities were probably characterized by a generalized subsistence pattern focusing on the margins of pluvial lakes.

A hypothesized warmer and drier climate between 6,000 and 4,000 B.C. may have resulted in partial abandonment of low-lying areas for more attractive resources at higher elevations. By 4,000 to 3,000 B.C. the basic food collecting life-style was established that persisted into historic times. During this time food processing tools such as manos, metates, mortars and pestles appear. Possibly as early as 2,000 years ago the bow and arrow appeared. This is shown archaeologically by a change to lighter points from the heavier dart points.

3. Archaeology

Figure 1 (Fig. 10) from Hall and Barker (1975) gives a basic sequence for the southwestern Great Basin. While evidence from the study area, is sketchy some of the time-sensitive projectile points have been collected in the study area. Silver Lake and Lake Mojave points were observed by the author in a private collection. Other point types reported for the

Figure 10

Figure 1

CULTURAL SEQUENCE

	Southwestern Great Basin	Local Phase Name	Diagnostic Artifacts
	LATE PREHISTORIC	Early Mohave Death Valley IV Early-Late Cottonwood Marana	Pottery Cottonwood points Desert Side-Notched points
1000	ROSE SPRING/ EASTGATE COMPLEX	Amargosa II Death Valley III ? Late Rose Spring Haiwee	Rose Spring points Eastgate points
AD BC 0	GREAT BASIN ARCHAIC	Early Milling.	Grinding tools
1000		Archaic Transition	Elko points
		Little Lake and Newberry	Gypsum Cave points
2000		Early-Middle Rose Spring	Pinto /Little Lake pts
3000		Death Valley II	Humboldt points
		Pinto Basin	Silver Lake points
4000			
5000	scanty occupation ?	none definite	Silver Lake points ?
6000			
7000	WESTERN PLUVIAL LAKES TRADITION	Western Lithic Co-Tradition Death Valley I Lake Mohave Complex San Dieguito Complex	Silver Lake points Lake Mohave points Crescents /Transverse points
8000			
9000	FLUTED POINT TRADITION ?	Fluted Co-Tradition	Folsom points ? Clovis points
10000			
	PRE-PROJECTILE POINT CULTURES ?		choppers teshoa flakes scraper planes

from Hall and Barker (1975)

study area include: Desert side-notched, and Pinto points (Rollin and Grace Enfield, personal communication, 1976). Hanks (1973a) mentions what were probably Elko points, and a crescent, found on the north playa edge. Clearly, even from this scanty evidence, occupation in the area may well date from 7,000-8,000 B.C. until historic times.

4. Archaeological Reconnaissance

One archaeological site, INY-1564 was recorded near the study area prior to field work. Numerous other sites were reported, but none was officially recorded. Prior to field work, information was obtained from the Desert Planning Staff, Bureau cultural resources files, and Mr. and Mrs. Rollin Enfield, archaeologists familiar with the area. Field reconnaissance was concentrated within one-half mile of the northern one-half of the sand dunes in the lower elevations of the proposed open area. Only the edges of the sand dune were surveyed, as previous surveys in the dunes proper had yielded no cultural resources. A five-day field reconnaissance was carried out on foot by the District Archaeologist, assisted by the Bishop Area Manager, who is familiar with cultural resources.

As estimated 80% of the area surveyed contained cultural artifacts, ranging from dispersed scatters of flakes to dense concentrations of flakes and tools. Probable aboriginal irrigation ditches were recorded. These were originally reported by Richard Patch in 1950 and have been examined by others, but had never been recorded.

Site boundaries were drawn on the basis of density and abundance of cultural materials and on the basis of differences in artifacts, where two or more sites are contiguous. An in-depth, systematic survey would be necessary to identify the boundaries more precisely. All areas called sites for the purposes of this report contained an estimated minimum density of ten flakes per square meter. Archaeologically sensitive areas are shown in Fig. 11.

5. Results

The recorded archaeological sites are discussed below:

INY-1564, located on the southwest side of the playa, is reported to be a major occupation site containing numerous projectile points, trade beads, shell beads and house rings. The site was not relocated by Hanks and Conrad in 1973. This site was not visited during this survey. It is located in an area currently closed to vehicle access.

EV-1 is an extensive scatter of flakes, flaked stone tools and fire affected rock extending along the north edge of the sand dunes, covering over 500 square meters. The area has received some impacts from recent camping and vehicle use.

EV-2 is a small, dense scatter of approximately 500 flakes, located on a gravelly rise above a blowout at the northeast end of the dune. The

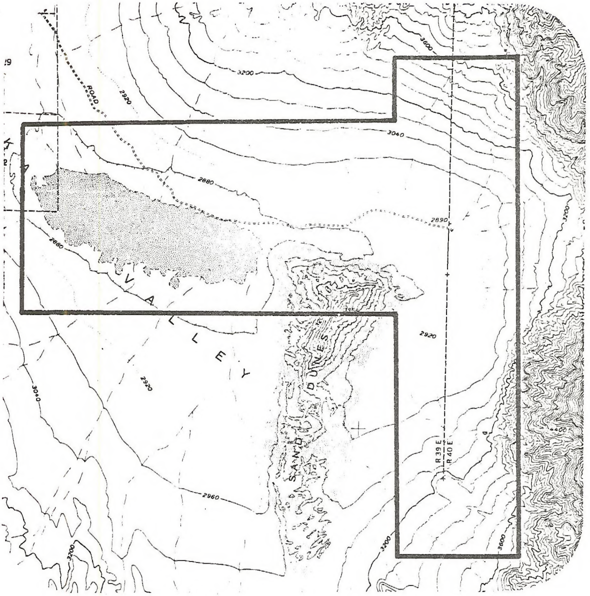


Fig. 11. Proposed Eureka Valley Archaeological District

stone material appeared to be non-utilized flakes of which 80% were obsidian and 20% were a grey-green chert-like material.

EV-3 is a dense scatter of chipped stone tools and flakes at the northeast corner of the sand dunes. Five sherds of pottery were also observed. The stone material has little surface erosion from sand blasting. One chert knife fragment was observed. The densest portion of this site covers over 500 square meters. Boundaries are very diffuse.

EV-4 is located on a low hill east of the sand dunes. The site contains three rock rings. Two of the rings are adjoining and the third is approximately 20 meters to the east. A few flakes were observed around the rings. Each of the two adjoining rings is approximately two meters in diameter. The site is located within 20 meters of an existing road and has sustained some impact from vehicles.

EV-5 is an isolated rock, ring located on the west end of a ridge extending from the Last Chance Range. The two meter-diameter ring was filled with blow sand. One obsidian flake was noted approximately 50 meters south of the ring. The ridge is covered with sand, which may be obscuring other artifacts.

EV-6 has been assigned to a vast lithic scatter along the eastern edge of the playa. Sandy hummocks along the edge of the playa contain small flake tools which may have been used in gathering plants for basketry.

Hanks reported a cache of metates at this site in 1973. It is estimated that between 80 and 90% of the flakes on the site have been used as tools. These flakes are highly sandblasted in comparison to other flakes and tools observed in the area.

EV-7 is located immediately east of and adjacent to EV-6. The boundary was established on the basis of differences in components and weathering on the flakes and tools. This site contains at least six loci of fire-affected rock, with flakes in association. Thousands of small obsidian flakes litter the sand along the western side of the base of the sand dune. It is believed that the small flakes have been transported to their present location by the wind. Neither they nor the larger flakes associated with the fire-affected rock appear to be sand blasted.

EV-8 is the most highly disturbed site recorded. It is located in the most frequently used camping and staging area for dune recreationists. Numerous modern campfire rings and vehicle tracks are on the site. The flake scatter is comprised primarily of non-utilized obsidian and chert flakes.

EV-9 has been assigned to the proported aboriginal irrigation ditches located on the eastern side of the playa. These ditches were first reported by Patch (1950). At that time a main ditch, a feeder ditch and three parallel ditches taking off at right angles from the main ditch, were visible. Hanks observed the main ditch and feeder ditch in 1973. He stated that two of three parallel ditches were barely visible then.

Clough's on-the-ground observations in 1976 could only locate the main ditch and feeder ditch. However, during an aerial reconniassance flight on May 25, 1976 the lateral ditches reported by Patch were observed from an altitiude of approximately 8,000 feet.

While natural cracks do occur in the playa surface, the regular alignment of these ditches, and their straightness, leads archaeologists to believe they are man-made. Irrigation of wild plants is reported by Steward (1938:53) for the Owens Valley Paiute.

It is evident from all accounts of the Eureka Valley area that aboriginal occupation has occurred over a long period of time. Steward (1938:79-80), in fact, mentions the extensive archaeological remains. He notes "spherical stone mortars of the type commonly used by the Shoshoni for grinding mesquite." He mentions a lack of pottery. Mr. and Mrs. Enfield stated that they have only found pottery on the eastern side of the dune. This is true for the present survey. Pottery occurred in late prehistoric times in the Great Basin and is indicative of more recent occupations than are represented by some of the other artifacts.

6. National Register of Historic Places

The National Register Criteria 36 CFR 800.10 were applied to the district encompassing the sites described previously. It is felt that this area is best represented as a district, as it is the significance of all the sites taken as a whole, that qualifies the area for nomination to the National Register of Historic Places.

The proposed Eureka Valley Archaeological District boundaries are drawn on Fig. 11 to conform to the UTM grid system. The boundaries were established to encompass only those areas containing known cultural resources. Boundaries should be revised and updated as new information becomes available.

The District appears to qualify for nomination under 36 CFR 800.10(a)(4); "districts that have yielded, or may be likely to yield information important in prehistory or history." This district has a potential to contribute valuable information in at least three research areas in archaeology; human adaptation to arid lands, human adaptation to climatic changes, and the study of prehistoric agriculture in the Great Basin and California.

In compliance with the Historic Preservation Act of 1966 (80 Stat., 915, P. L. 89-665), Executive Order 11593, and 36 CFR 800, any undertaking that may have an effect on cultural resources which may qualify for nomination to the National Register of Historic Places must be submitted to the Advisory Council on Historic Preservation for review and comment. Initially, BLM must submit documentation to the State Historic Preservation Officer for his concurrence on our application of the National Register Criteria, and for his agreement with our findings of impact by whatever the final recreation proposal will be.

c. Social Welfare

The most significant flow and distribution of money, goods, and services within the subject area is a result of recreational pursuits. Most recreationists travel from communities within the Owens Valley and Mammoth Area. While there are no services within these communities entirely dependent upon the recreational activities occurring at the Eureka Dunes, some benefits are received by the appropriate businesses. Motorized recreation contributes the higher percentage of economic benefits. Quantified data is unknown.

Currently, the use demand appears to be divided between motorized recreation vehicle activities and non-motorized recreation activities. Over time, motorized recreation tends to displace some other recreational activities. This has been documented in several areas and discussed by Badaracco (1976). Letters to the Bakersfield District BLM have indicated that former dune users no longer return to the dunes because of their feelings about ORV use. (File available for review, Bishop Area Office, BLM).

Recreation is very important to the American citizen. The ever increasing amount of leisure time and discretionary income available is causing some profound changes in the American lifestyle. This is evident in the fast-growing recreation business. In California the increase in recreational activities has been channeled, at a generally increasing rate, into the off-road vehicle.

The sale of off-road vehicles has increased from 7 percent to 9 percent per year since 1969 (Honda et. al 1973). There are an estimated 1.8 million motorcycles (M.O.R.E. 1973), 650-750 thousand four-wheel drive vehicles and an undeterminable number of reconstructed vehicles (dune buggies) in the State of California. Nearly 15 percent of California's population own or have access to an off-road vehicle.

Statistics relevant to four-wheel, off-road vehicles are incomplete, due to registration inconsistencies. Approximately 87 percent of all registered off-road vehicles in California are motorcycles, and only 11 percent are four-wheel vehicles. This does not represent the total RV picture, simply because, until 1971, with the enactment of the Chappie Z'Berg Act, non-street, legal RV's were not required to be registered. Also, most four-wheel drive vehicles that are legal for street use are registered as stationwagons to reduce registration fees.

Membership in recreational vehicle clubs and associations is increasing from 15 to 20 percent per year (Edwards 1973) or roughly at double the rate of the ORV recreational activity. This rapid growth is partially a result of the increased need to make ORV recreationists' desires known to legislative and land management agencies. There are also obvious social benefits.

Unfortunately few studies exist that might hint at future demands, based on simple desire for RV recreation. Many recreation planners feel that a physical and psychological need is being met through RV activity. Others feel it is simply a fad that will soon disappear.

In southern California, recreational activities revolving around off-road vehicles have grown much faster than elsewhere in the U.S. This is probably due to the availability of vast expanses of public land relatively near large metropolitan areas. If all economic conditions and the availability of use areas were to remain constant, the growth of the popularity of RV's for recreational purposes would probably continue to grow, at least in the short run. (Riverside District Office, BLM, 1974).

The planned paving of the Eureka Valley Road into Death Valley National Monument may change the amount and type of recreational use at Eureka Dunes. This would affect the welfare of surrounding service-providing businesses, mostly in the Owens Valley, by bringing increased activity to the area.

Social welfare from recreational pursuits extends beyond the flow and distribution of money, goods,and services. Recreation contributes to the health and welfare of the general public. The enjoyment of the out-of-doors, the relaxation and the spiritual refreshment to be found in recreation can not be measured in material terms.

d. Attitudes and Expectations

Diverse and polarized attitudes and expectations exist (Badaracco, 1976; BLM letter files, Bishop) concerning the Eureka Dunes. There are those (vehicle enthusiasts and non-vehicle users alike), who have been using the dunes for years with no restrictions or controls. They stongly resist restrictions on their pursuits and activities. They feel public land is being closed to them. A frequent complaint is that there is no place left to pursue their leisure time activities and life styles.

Others feel that the area is being damaged by uncontrolled use. They feel the area possesses unique features worthy of protection. They object to ORV use impacting the ecology of the area and disturbing other non-ORV leisure activities.

e. Local Regulatory Structures

The Eureka dunes area is included in the Inyo County General Plan. It has been identified by the Inyo County Planning Commission as a natural reserve because of its unique features. The Inyo County Sheriff Department is responsible for enforcement in the rural areas of the county, and the Inyo County Road Department has responsibility for maintenance of the major access road to the subject area.

II. DESCRIPTION AND ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES

PROPOSED ACTION: VEHICLE USE, NORTH HALF (Day Only)

Management Program

The proposed action would open the north half of the dune area to all recreation uses, including vehicle use. All recreation uses except vehicle use would be permitted from the highest peak of the dunes southward. The north half of the dunes would be open to vehicles down to the base area. The portion of the Special Design Area from the base of the dunes eastward to the base of the Last Chance Mountains would be Closed to vehicular use except for the existing vehicle corridor to Saline Valley. (Fig. 12) Night use of the dunes by dune vehicle would be prohibited.

Significant Aspects

This alternative represents a compromise between conflicting recreational uses of the dunes as well as related non-recreational activities. It would continue present use patterns of vehicles on the steeper, more challenging slopes of the taller dunes of the Eureka Dune system. It would preclude further development of vehicle use in the south portion of the dunes, which has thus far experienced little such use.

This alternative would provide more dune area free of vehicle activity and would benefit more non-vehicular recreation activities than would Alternative A: Vehicle Use. Some activities, such as sand sliding, hang-gliding and rock-hounding might be adversely affected depending upon the degree to which they rely upon vehicle use in the special design area for their attainment.

Some increase in BLM management activities in the dune area would be associated with this alternative, primarily to provide for public health and safety, and to enforce vehicle use restrictions.

1. Anticipated Impacts

Air

The air quality in Eureka Valley would be impacted by the addition of auto exhaust components: both transportation and random recreation vehicle use would contribute. The amounts are presently not significant and do not exceed the Federal and State Ambient Air Quality Regulations. Any future increases in recreation demand would increase total exhaust emissions to an unknown degree. If the "half open to vehicles" status causes vehicle enthusiasts to forsake coming to Eureka Valley, their off-road vehicle fumes would not be added to the air basin. If this status encourages former Eureka Dunes non-vehicle users to resume their visits, then their transportation vehicle fumes would be added to the air basin.

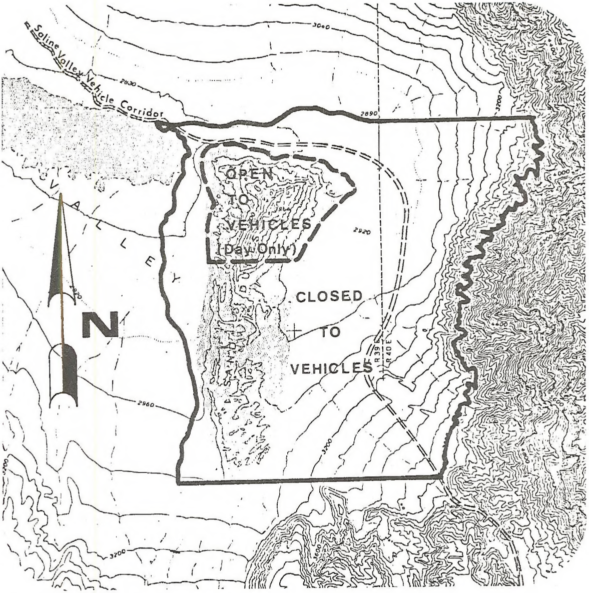


Fig. 12. Proposed Action
Vehicle Use, North Half

━━━━━━ **Special Design Boundary**

— — — — — **Use Area Boundary**

Geology

The physical effects of vehicle use on the Eureka Dune system may be manifested by temporary compaction of the sand structure directly beneath the wheels, by temporary change in the dune morphology, and by a reduction in the moisture content of the dunes.

As the sand compacts beneath a wheel or a foot, the sand on either side of the vehicle wheel or foot is subjected to a shearing force, and the sand grains are rearranged into a looser configuration on either side of the compacted sand directly beneath the track. When another vehicle rolls over the sheared area just mentioned, this area undergoes compaction and the previously compacted area undergoes the shearing process. This results in a cancelling effect.

The individual sand grains consist mostly of quartz. They are very hard and resistant to chipping and breaking. Subsequently they are not damaged by vehicle use.

A high level of vehicle use tends to round off the sharp crests and shift the sand downhill. The tracks may remain from a few hours to a few days until the wind reshapes the crests and swales.

Current information indicates that the total dune shape down to the individual small crests, ridges, and swales has not changed since 1952. (comparative aerial photos 1952-1975 available for review, Bishop Area Office, BLM). Wind has been reshaping the dunes after current levels of vehicle use.

At the current use levels, the moisture content of the dune is being and would continue to be, impacted to an unknown degree. As vehicles and humans travel over the slopes, the dry sand surface layer slips downward, exposing the moist layer beneath. This rapidly dries. On steep slopes the slipfaces are very large. This not only mechanically destabilizes the sand, and promotes erosion, but it also results in removal of moisture from the immediate interior of the dune aquifer to replenish the moisture in the dried surfaces. This is a mechanical attempt to reestablish a moisture equilibrium profile. With enough vehicle use, the total percentage of water held in the dune would be lowered until rain falls. The hydrology of the dune system must be studied before a complete evaluation of this factor is made.

Although both vehicle and pedestrian uses have a similar slipping and drying effect, a vehicle impacts more than a hiker by virtue of the total tire surface area moving on the dune and the greater distance covered in a given period of time.

Unlike the sand dune, other soil types in the Special Design Area are residually compacted by vehicle use. Vehicle use on the playa currently occurs, although the playa is within the Saline Closed area. Increased use in the Special Design area will probably result in increased unauthorized vehicle use on the playa. The silty clays and salts on the playa pulverize to a high degree, and compact beneath the feet of a pedestrian or the wheels of a vehicle. The pulverized salt crystals are extremely susceptible to wind erosion. As mentioned above, vehicles impact more significantly than pedestrians because, although the greater area touched in a stationary position results in lower psi (pounds per square inch), for vehicles as compared with people, more thrust pressure occurs for vehicles, and they travel farther in a given time period. The alluvial fans in the Special Design area are more susceptible to environmental damage than the playa, and less susceptible to compaction and erosion than the lake sediments. Repetitive use over time will compact the alluvial soil. This is more significant than on the playas or lake sediments because compaction causes decreased infiltration and percolation and subsequent increased runoff and erosion. Because plants do not readily revegetate compacted soils, compaction and erosion is often a long-term effect.

Flora

The dune vegetation on the north half of the dunes could be impacted in several ways. The Proposed Action will allow both vehicle and pedestrian activities on the north half. Direct damage occurs when vehicles run over plants or feet step on them. Damage also occurs when vehicles or people pass just above or just below a plant. Sand slips down and covers it in the first instance, often to such a degree that regrowth cannot occur. In the second instance roots are often undercut and exposed to the drying air which can kill or maim a plant. In both instances the roots are usually bruised and cut by the loose shifting of the sand.

Most of the vegetation on the dunes is generally of a low sparse profile which does not promote avoidance or "non-contact" responses in uninformed hikers or vehicle drivers. Some mounds of dune grass are large enough to initially enact an avoidance response or to serve as a stabilizing rest spot for a person or a vehicle faltering in the climb. The main population of the Eureka dunegrass which reproduces both by seed and by runner is found scattered fairly evenly on the lower dunes. Although its adult physiology is moderately resistant to direct damage, the significance of individual plant loss is high because of limited numbers of the total population, and a scattered low population density throughout the dunes.

Young dunegrass plants have comparatively small, shallow root structures and just a few stems and leaves which are somewhat softer than those on mature plants. Because of this, the young plants are more susceptible to physical destruction. The continued use on the dunes may be causing lower survival rates of these young plants than would otherwise occur.

The Endangered Eureka Valley evening primrose is extremely susceptible to physical impacts during the spring and early summer when it is growing and flowering. During the rest of the year, after the plant dries, the perennial rootstalk is relatively protected under level sand. It is not as protected on the few slopes it may be found because the sand shifts. The endemic shiny locoweed is moderately to highly susceptible to physical destruction and has the smallest population of the three dune endemics.

The Bureau has had four permanent photo-trend plots for Eureka dunegrass established on the dune since the spring of 1975. The plots were photographed one time in the spring of 1975, and one time in the spring of 1976. The first year results show increases in percent cover of dunegrass. Because the plots have been in place but one year, conclusions can not be drawn (file available in BLM Bishop Office).

A private individual has conducted studies on dune grass on seven transects on the north end of the dunes. They have been in place since 1974 and have been visited four times. The results show decreases in numbers of dunegrass plants. Because the plots have been in place only two years, conclusions can not be drawn.

The non-endemic dune plants vary in their ability to withstand physical impacts from feet and vehicles. All plants have a limit, past which vegetative degeneration, lack of reproduction, and population loss occurs. Some species, for instance, desert dicoria, are believed to be key energy transfer species in the ecosystem, and are depended upon by fauna for much of their food. Desert dicoria provides large amounts of flowers and seeds in the fall and winter, when few other plants bloom (DeDecker 1976). Key relationships are not yet fully understood; an ecosystem is comprised of organisms, each with a function. When one species is lost or significantly decimated, niche (function) substitutions and gaps begin to occur.

The non-dune vegetation, being large and shrubby, is moderately to highly resistant to physical impacts. This type of vegetation mostly occurs on alluvial fans. In the special design area these occur on the land north of the dunes, beyond the commonly used camping area.

"There have been several recent studies on the effects of motorcycle races and off-road vehicle use on vegetation, in the Mojave Desert (Davidson, 1973; Keefe et al., 1973; Gibson, 1973; Davidson and Fox, in press). These studies not only discuss general effects, but quantify impact and damage, i.e., number and kinds of shrubs and annuals damaged or destroyed in pits, camping and start areas, and along race-courses.

In general, the field studies show that off road vehicle use:

a. reduces the number of shrubs

b. reduces the diversity of shrub species by selectively impacting the smaller, more fragile species

c. reduces the numbers of annual wildflowers that will germinate and flower in following years

d. reduces the diversity of annual wildflowers

e. favors growth of some exotic weeds

The extent of reduction in numbers and diversity of shrubs and annuals is related to the number of motorcycles in the race and whether the impacted site is part of the course or is in a pit area (camping and gas stop site). There are three generalizations that can be made here: impacts increase as numbers of motorcycles and other vehicles increase; repeated use intensifies the damage; repeated use lengthens the period of recovery." (BLM, 1974; Final EIS, Barstow - Las Vegas Motorcycle Race).

As vehicle use increases within the Special Design Area, the above analysis of effects on vegetation would be more applicable, although to our knowledge competitive events have not occurred in the area.

Other studies have also shown that off-road vehicles are detrimental to vegetation and that vegetation is eventually destroyed in areas of repeated use (Luckenback, 1975; Stebbins, 1974; T. Duck, presented at 1976 Annual Meeting Southern California Acadamy of Sciences Symposium; F. B. Turner, S. T. Vollmer, B. G. Maza, and P. A. Medica, presented at 1976 meeting SCASS; Hadley, R. F. USGS, unpublished).

Increased vehicle use on the north half of the dunes would degrade and eventually destroy the dune flora, including the Endangered Eureka dunegrass, scattered shiny locoweed and Eureka Valley evening primrose (Endangered). Present use levels concentrated into the smaller area would intensify the degradation rates. The flora on the south end would be protected from vehicle use but would still be subject to pedestrian impacts. If the gene pool of the remaining dunegrass on the south end and Marble Canyon, and those of the other two species in the Closed areas surrounding the dunes were insufficient to maintain these species, then they could slowly die out. Maintenance level gene pools (population numbers sufficient to maintain the production levels) are not known for any of these species.

Mary DeDecker, the recognized authority on flora of the Owens Valley and the desert areas east of the Sierra Nevadas, feels that the Marble Canyon population of dune grass and other endemics might not survive several consecutive extreme drought years because the shallow sand would not be able to store sufficient water to support the plants.

The Endangered Species Act of 1973 mandates all Federal agencies to "carry out programs for the conservation of endangered species and threatened species . . . to insure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of such . . . species or result in the destruction or modification of habitat of such species, which is determined by the Secretary, . . . to be critical."

BLM's Program to Ensure Compliance with the Endangered Species Act of 1973, (P.L. 93-205), enclosure to Instruction Memorandum 75-152 (see

Appendix E), April 1, 1975, states that the BLM is also responsible for indirect actions on its part, which may affect threatened or endangered species adversely.

The flora list proposed by the Smithsonian has now been published in the Federal Register for Endangered and Threatened Classification June 16, 1976 and is awaiting the closure of a 90-day comment period before becoming official.

Fauna

The Proposed Action would detrimentally impact the dune dwellers on the north half of the dunes. These fauna are susceptible to direct crushing, the loss of burrows and unintentional harassment by vehicles and, to a lesser extent, pedestrians. Vehicles churn the sand, crushing creatures hiding under the surface and in their burrows. The creatures that are not killed but lose their burrows may die from shock and dehydration. An example is the desert kangaroo rat which depends upon its burrow for a cool moist shelter and for storage of relatively moist seeds. Populations continually frightened by noise may fail to reproduce and may try to leave the area.

Pedestrian travel kills burrowing fauna, especially lizards, snakes and insects. A BLM employee-witnessed occurrence of pedestrian contact with a shallowly buried desert iguana shows that a random foot fall can kill lizards. Fragile burrows will collapse under foot pressure.

Present recreation use levels, although not high, have reportedly resulted in loss of kangaroo rat colonies and in an apparent lower densities of beetle populations since about 1972. Derham Giuliani, an entomologist, has had increasing difficulty in locating and collecting the dune beetles and other dune insects. He suggests that from his experience, a rough estimate of the average insect decline could be tabulated. (letter, May 6, 1975, BLM files, Bishop Area Office).

Possible losses of these insects are evolutionarily significant because of their remarkable adaptions and endemism.

In addition, Derham Guliani has documented the decrease and disappearance of a large desert kangaroo rat colony in a sandbowl in the north half of the dunes. Here he collected five species of dune insects that inhabit kangaroo rat burrows, three of which he had not found elsewhere on the dunes.

In 1973, he noticed vehicle use in the bowl, although less than in other parts of the dune because of the steep sides. In 1974 he states that only five or six kangaroo rat burrows could be found, less vegetation was left, the area was not the prime insect habitat it had been previously, and a large sand bee colony had disappeared. He stated in his May, 1975 letter that in the spring of 1975, all kangaroo rat burrows and vegetation were gone from the bottom of the bowl. Studies from the

Barstow to Vegas Motorcycle Race have shown similar results, that small fauna species are lowered in density and abundance after vehicle use in their habitat. (1974 Barstow - Las Vegas Motorcycle Race Evaluation Report, March 1975).

As a result of the enployment of this alternative over the years, predators that enter into the dune ecosystem, but dwell in the surrounding habitats, would face a lessened food source in the north half of the dunes. For many of these predators, the dune system does not comprise the only food source, so the loss would be of lower significance. Kit fox would probably be significantly impacted, because their primary prey species, the kangaroo rat, dwells on sandy substrate on and around the dunes near vegetation. Kit fox are shy creatures, easily disturbed by humans and vehicles. Raptors and coyotes have large ranges and many food sources, so would shift their territories to make up for the prey loss and to avoid disturbance. Because the rest of the Special Design Area is closed in this alternative, populations on the south end, and non-dune species would be impacted less depending upon management success and public cooperation.

Ecosystem

Increases in vehicle use, and continued use further degrade ecosystems already subjected to vehicle use (Keefe and Berry, 1973). With an increase in population, increased leisure time, official Bureau designation, and word-of-mouth advertisement, use demand for the Eureka Dunes for recreation is likely to increase, along with increased use elsewhere in the desert. This increase is shown by past use numbers, present use numbers, and projected trends. Off-road vehicle use is increasing along with other forms of recreation (See Social Welfare section). (BLM, Riverside District Office, 1974).

The dunegrass on the north end of the dunes, and non-endemic dune plants, may first decrease in size, vigor and abundance, then disappear over wide areas, in response to increased vehicle pressure. Food and protective habitat loss for dependent fauna would decrease faunal populations. Predator populations would then shift territories over time to other areas, and a general lower carrying capacity for the south end of the valley would be created.

Human Values

Cultural Resources

This alternative would have an adverse impact on cultural resources, proportional to the amount and area of vehicular use on the dune margins that contain archaeological sites.

As the existing parking and vehicle access area, on the northwest end of the dune, is on top of an archaeological site, continued use of this area would result in further degradation of the cultural resources, eventually leading to total destruction of this major site. Beneficial impacts would accrue to the archaeological sites located within the enforced closed area by eliminating vehicular use on top of the sites and restricting vehicular access for those intent upon illegal collection of artifacts.

Social Resources

Money would be spent in Owens Valley by recreationists buying supplies and passing through. The amount would increase as numbers of users increase.

Vehicle users would be restricted to the north half, but would still be able to pursue their activities, and realize the social, physical, emotional, and mental benefits derived from their pursuits.

The south half of the dunes would provide non-vehicular recreationists with a place to enjoy their activities in safety from vehicles on a relatively non-degraded dune formation. Solitude, which for many people is enhanced by silence, would be obtainable during vehicular use periods only by hiking to the southern one-half of the south half of the dune, because noise from off-road vehicles often would extend into the vehicle Closed area (See latter to BLM in Eureka Dunes file).

The pedestrian use of the south half of the dune would not be likely to be high, because a hike of over a mile would be necessary to reach the area closed to vehicles. This would preclude families with young, old, or handicapped members from enjoying nonvehicular activities in relative safety, in non-vehicle-impacted dunes. However, present use levels by vehicles are low enough that this would only be a problem on some weekends and holidays. Closing the south half to vehicles will decreast the area in which vehicle recreation can take place, possibly creating more crowded conditions during peak use periods.

If the closures were abided by large amounts of vehicle impact information would be gained if priority, manpower, and money were allocated for studies. Ecological trend studies could be initiated to analyse vehicle impacts. Aquifer moisture studies could provide data on potential moisture losses. Biological data on some of the endemic flora and fauna might be lost before it could be collected, if the south half could not support a large enough gene pool for the continuance of each endemic species of flora and fauna.

Management Resources

The choice of this alternative would require that a Recreation Management Plan be formulated and carried out. It would also require ranger patrol when dune vehicles were present to ensure compliance. The degree of cooperation by the public would determine the need for extra enforcement activities.

2. Possible Mitigating or Enhancing Measures

a. Post the boundaries of the vehicle use areas with an interpretive map sign to indicate the locations of the "Closed to Vehicles" areas. This should help to protect the habitat in the Closed areas.

b. Designate parking, picnic and campground areas and their boundaries, to prevent these activities from spreading all along the base of the dunes.

c. Develop sanitary facilities and place garbage cans.

d. Develop an interpretative center explaining the natural features of the dune ecosystem and ways in which recreation impacts the ecosystem. Include a display and brochures asking for thoughtful and conservative behavior, i.e., please don't crush the vegetation.

e. Establish a gravel road from the present parking area, along the west edge of the dunes, to the north part of the south half of the dunes, to provide non-vehicular recreation access to the "Closed to Vehicles" half. Provide facilities for sanitation and camping at the road end.

f. Establish and monitor additional photo trend plots and vegetative study transects both on and around the dunes. Establish and regularly monitor fauna population trend study plots.

g. Prior to implementation of this alternative, all areas designated for vehicle access to the dunes should be intensively surveyed and all archaeological sites salvaged by qualified professional archaeologists. Access areas should be clearly demarcated to confine vehicles, and to avoid impact to other cultural resources of the dune area. All camping and parking areas should be restricted to avoid impacting cultural resources. The number of points of vehicular access to the dunes should be kept to a minimum to lessen the adverse impact to archaeological remains. An interpretive signing program should also be used to discourage illegal collecting of artifacts and to increase public appreciation of cultural values.

3. Recommendations for Mitigation or Enhancement

All of the possible mitigating measures listed above are recommended.

4. Residual Impacts

Air quality of the valley would be adversely impacted to a less than significant degree by this alternative. The dune forms would be temporarily loosened and broken by vehicle use on the north half. The moisture content of the dunes may continue to be lowered to an unknown degree on the north half. Off-dune vehicular use and vehicular use into the south end of the dunes would continue to occur but the signs should eliminate innocent trespassing.

As a result of the increase in recreation activity, the vegetation and fauna on the north end would decline in vigor, population density, and numbers until the ecosystem could simplify to the point of failure on that half.

Dune vehicular recreationists would continue to enjoy their ORV pursuits on the north half. Conservationists would continue to point to Eureka Dunes as an ecosystem compromised to consumptive recreation. The recreation experiences of some non-vehicular users would continue to be impaired on the north half, but these users would have access to the south half of the dunes. Archaeological resources would be residually impacted wherever adverse impacts occur.

B. Relationship Between Short-Term Use and Long-Term Productivity

Short-term use would be defined as that time in which the recreational use occurs on the dunes. This period would end if the dunes were ever closed, in the future. Long-term productivity relates to that time in which residual effects of the recreation continue to be felt by the environment.

The air quality would not be harmed on a long-term basis by the implementation of the proposed action. The dune geology and the playa surface would not be harmed significantly on a long-term basis, nor would the long-term productivity of the lake sediments be lowered.

If ORV use continued or increased commensurate with estimated increases for the total desert, the Endangered Eureka dunegrass could be exterminated on the north half of the Eureka Dunes, leaving only the population on the south half and a marginal population in Marble Canyon. If those populations were not sufficient to maintain the species, the dunegrass could become extinct in the wild. The four known endemic dune beetles could also suffer a population loss on the north half of the dunes. The ecosystem would be greatly impaired and changed on the north half. Some type of recovery would occur within an unknown length of time if vehicular recreation ceased.

The short-term use for vehicular recreation would destroy some archaeological remains around the margins of the dune, eliminating them as possibilities for future scientific study and from the cultural heritage resource.

C. Irreversible and Irretrievable Commitments of Resources

If the gene pools and water supplies of the dunegrass and the endemic beetles were sufficient to maintain these species on the south end of the dunes and in Marble Canyon, these resources would not be irreversibly committed. If the populations declined, then these organisms might be irreversibly committed.

Any damage to or destruction of cultural resources would be a permanent commitment of resources. These archaeological remains cannot ever be replaced or reconstructed, once damaged or destroyed.

III. ANALYSIS OF ALTERNATIVES

A. Environmental Impacts

ALTERNATIVE A: VEHICLE USE

Management Program

Open the whole dune to all recreation uses, including vehicle use. The dunes would be treated as Open down to the base area. The portion of the Special Design Area from the base of the dunes eastward to the base of the Last Chance Mountains would be Closed to vehicular use except for the existing vehicle corridor to Saline Valley. (Fig. 13)

Significant Aspects

This alternative would emphasize vehicle-related recreational use of the dune area. It would be reasonable to expect this to range from those uses requiring automobile access, such as camping, picnicking, and sightseeing, to those activities for which the use of an off-road vehicle would be the major purpose. This type of use is expected to increase in future years due to word-of-mouth promotion, increased leisure time, increases in local and distant populations, the open designation, and planned paving of the Eureka Valley road.

Other uses, primarily those related to hiking, nature study, or the enjoyment of solitude would be permitted, but could at times be adversely affected by the use of vehicles for other activities. Unique activities, such as hang-gliding, sand skiing, and search-and-rescue training would probably not be adversely affected. Some increase in BLM management activities in the dune area would be associated with this alternative, primarily with regards to public health and safety.

1. Anticipated Impacts

Air

The air quality in Eureka Valley would be adversely impacted by the addition of auto exhaust components; both transportation and random recreation vehicle use would contribute. The amounts of air pollution contributed by vehicles in this area are presently not significant and do not exceed the Federal and State Ambient Air Quality Regulations.

Geology

The physical effects of vehicle use on the Eureka Dune system may be manifested by temporary compaction of the sand structure directly beneath the wheels, by temporary change in the dune morphology, and by a reduction in the moisture content of the dunes.

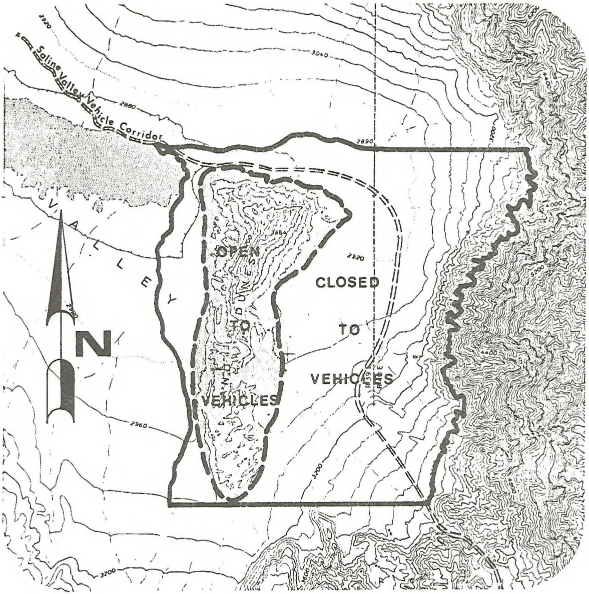


Fig. 13. Alternative A

Vehicle Use

━━━━ Special Design Boundary

— — — — — Use Area Boundary

The sand on either side of a vehicle wheel or a foot is subjected to a shearing force and the sand grains are rearranged into a looser configuration on either side of the compacted sand directly beneath the track. When another vehicle rolls over the sheared area just mentioned, it undergoes the shearing process. This results in a cancelling effect.

The individual sand grains consists mostly of quartz. They are very hard and resistant to chipping and breading. Subsequently they are not damaged by vehicle use.

A high level of vehicle use tends to round off the sharp crests and shift the sand downhill. The tracks may remain from a few hours to a few days until the wind reshapes the crests and swales. The present levels of vehicle use are not detrimental to the dune conformation. Current information indicates that the total dune shape down to the individual small crests, ridges, and swales has not changed since 1952. (comparative aerial photos 1952-1975 available for review, Bishop Area Office, BLM). Wind has been reshaping the dunes after current levels of vehicle use.

Under current use levels, the moisture content of the dune is being and would continue being impacted to an unknown degree. As vehicles and humans travel over the slopes, the dry sand surface layer slips downward, exposing the moist layer beneath. This rapidly dries. One steep slopes the slipfaces are very large. This not only mechanically destabilizes the sand, and promotes erosion, it also results in removal of moisture from the immediate interior of the dune aquifer to replenish the moisture just under the sand surface. This is a mechanical attempt to reestablish a moisture equilibrium profile. With enough pedestrian or vehicle use, this could lower the total percentage of water held in the dune until rain falls.

Although both vehicle and pedestrian uses have a similar slipping and drying effect, a vehicle impacts more than a hiker by virtue of the total tire surface area moving on the dune and the greater distance covered in a given period of time.

Compaction is not the major residual problem on sand that it is on other soil types. Vehicle use on the playa currently occurs, although the playa is within the Saline Closed area. Increased use in the special design area will probably result in the increased vehicle use on the playa. The silty clays and salts on the playa pulverize to a high degree and compact beneath the feet of a pedestrian or wheels of a vehicle. The pulverized salt crystals are extremely susceptible to wind erosion. Vehicles impact more significantly than pedestrians because although the greater area touched in a stationary position results in lower psi (pounds per square inch), for vehicles compared to people, more thrust pressure occurs for vehicles and they travel farther in a given time period. The alluvial fans in the special design area are more susceptible to environmental damage than the playa and less susceptible to compaction and erosion than the lake sediments. Repetitive use over time will compact the alluvial soil. This is more significant than on the playas or lake sediments because compaction causes decreased infiltration and percolation and subsequent increased runoff and erosion. Because plants do not readily revegetate compacted soils, the compaction and erosion is often long-term.

The remnants of the lake sediments around the dunes are extremely susceptible to compaction from vehicle and pedestrian travel. These sediments are primarily clay and easily compacted and eroded by the wind. Current numbers of pedestrian off of the dunes are of low significance, but evidence of vehicle tracks encourages additional vehicle activities which is of significance.

Flora

The dune vegetation can be impacted in several ways. This vehicle use alternative will allow both vehicle and pedestrian activities on the dunes. Direct damage occurs when vehicles run over plants or feet step on them. Damage also occurs when vehicles or people pass just above or just below a plant. Sand slips down and covers it in the first instance, often to such a degree that regrowth cannot occur. In the second instance roots are often undercut and exposed to the drying air which can kill or maim a plant. In both instances the roots are usually bruised and cut by the loose shifting of the sand.

Most of the vegetation on the dunes is generally of a low sparse profile which does not promote avoidance or "no-contact" responses in uninformed hikers or vehicle drivers. Some mounds of dunegrass are large enough to enact an avoidance responce or to serve as a stabilizing rest spot for a person or a vehicle faltering in the climb. The main population of the Eureka dunegrass which reproduces both by seed and by runner is found scattered fairly evenly on the dunes. Although its adult physiology is moderately resistant to direct damage, the significance of individual plant loss is high because of limited numbers of the total population, and a scattered low population density throughout the dunes.

Yound dunegrass plants have comparatively small root structures and just a few stems and leaves which are somewhat softer than those on mature plants. Because of this, the young plants are more susceptible to physical destruction. The continued use on the dunes may be causing lower survival rates of these young plants than would otherwise occur.

The Endangered Eureka Valley evening primrose is extremely susceptible to physical impacts during the spring and early summer when it is growing and flowering. During the rest of the year, after the plant dries, the perennial rootstalk is relatively protected under level sand. It is not as protected on loose slopes. The Threatened shiny locoweed is moderate to highly susceptible to physical destruction and has the smallest population of the three dune endemics.

The non-endemic dune plants vary in their ability to withstand physical impacts from feet and vehicles. All plants have a limit past which vegetative degeneration, lack of reproduction, and population loss occurs. Some species, for instance desert dicoria, are believed to be key energy-transfer species in the ecosystem, and are depended upon by fauna for much of their food. Desert dicoria provides large amounts of flowers and seeds in the fall and winter when few other plants bloom. Key relationships are not yet fully understood; an ecosystem is comprised of organisms, each with a function and when one species is lost or significantly decimated, niche (function) substitutions and gaps begin to occur.

The non-dune vegetation, being large and shrubby, is moderately to highly resistant to physical impacts. This type of vegetation mostly occurs on alluvial fans. In the Special Design Area these occur on the land north of the dunes, beyond the commonly used camping area.

This alternative, allowing all types of travel, would subject all dune vegetation to increasing pressures from foot travel and vehicular travel as population pressure, leisure time and popularity of the area increase. The dunegrass would reach its tolerance limits as vehicle use continued to increase, and would begin a decline toward extinction with repetitive heavy vehicle use. The population of endemics in Marble Canyon may not be permanent population, because during a series of drought years, the shallow sand in that area may not hold sufficient water to support the populations of dunegrass and the locoweed and primrose.

Under the Vehicle Use alternative, and continued vehicle use, the scattered Eureka Valley evening primroses on the dunes would decrease and disappear. The main population on the east side would be fairly protected, as would the population to the southwest and at the south tip. Vehicle trespass and pedestrian traffic into the Closed east portion and the Saline Closed area would destroy some of these plants.

With continued and increased recreation activities, the shiny locoweed would suffer a high percentage of population loss on the north dune edge because its main population occurs mostly where camping fringe activities take place and where campers would be likely to travel to and from the dunes either by vehicle or foot. Ultimately it may disappear. This can not be allowed. The Endangered Species Act of 1973, P.L. 93-205, as stated before, mandates all Federal agencies to take "action necessary to insure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of such endangered species and threatened species or result in the destruction or modification of habitat of such species. . ." Because the flora list proposed by the Smithsonian for endangered and threatened classification has now been published in the Federal Register June 16, 1976 and is awaiting a 90-day comment period before becoming official, the Bureau will manage NRL for flora under the 1973 Endangered Species Act.

Definitive information is lacking on whether present use levels are significantly harming the endemic and non-endemic dune plants. This alternative would be expected to decrease the populations of each species on the dune to a degree corresponding to user increase and pressure tolerance of each species. The alternative would not greatly impact non-dune vegetation found on the alluvial fans because little use is anticipated to occur beyond the common use camping areas north of the dunes. Camping has already destroyed the vegetation and campgrounds would probably be designated in these common use areas.

Fauna

The vehicle use alternative would detrimentally impact the dune dwellers. They are susceptible to direct crushing, the loss of burrows and unintentional harassment by both vehicles and to a lesser extent, pedestrians. Vehicles churn the sand, crushing creatures hiding under the surface and in their burrows. The creatures that are not killed but lose their burrows may die from shock and dehydration. An example is the desert kangaroo rat which depends upon its burrow for a cool moist shelter and for storage of relatively moist seeds. Populations continually frightened by noise may fail to reproduce and may try to leave the area.

Pedestrian travel kills burrowing fauna, especially lizards, snakes and insects. A BLM employee-witnessed occurrence of pedestrian contact with a shallowly buried desert iquana shows that a random foot fall can kill lizards. Fragile burrows will collapse under foot pressure.

Present recreation use levels, although not high, have reportedly resulted in loss of kangaroo rat colonies and in an apparent lower densities of beetle populations since about 1972.

As a result of the employment of this alternative over the years, predators that enter into the dune ecosystem but dwell in the surrounding habitats would face a lessened food source moreso than in the proposed action. For many of these the dune system does not comprise their total food source so the loss would be of lower significance. Kit fox would probably be significantly impacted because their primary prey species, the kangaroo rat, dwells on sandy substrate on and around the dunes within and near mounds of dunegrass. Kit fox are shy creatures easily disturbed by humans and vehicles. Raptors and coyotes have large ranges and many food sources, so would shift their territories to make up the loss and avoid disturbance. Because the rest of the Special Design Area is closed in this alternative, non-dune species would be impacted less depending upon management success and public cooperation.

Night use of the dunes would intensify impacts on the fauna. Snakes, geckos, and rodents are active at this time and usually are not able to dodge quickly moving vehicles. When active they are able to avoid the slow pedestrians. In addition, off-dune predators are predominantly nocturnal and would be frightened by vehicles as well as pedestrians. This would prevent them from hunting on established known territories during the months of vehicle use. These months are also times of young-rearing when disturbance and territory loss are more significant.

Ecosystem

Repeated use of ORV activity in the desert intensifies trends of decreased canopy cover and shrub density with the end result being complete denudation of disturbed sites (Davidson, 1973). The dunegrass and non-endemic dune plants would decrease first in size, vigor and abundance, then disappear over wide areas of dune in response to repeated vehicle pressure. Food and protective habitat loss for dependent fauna would decrease faunal populations. Predator populations would then shift territories over time to other areas, and a general lower carrying capacity for the south end of the valley would be created.

Human Values

Cultural Resources

This alternative would have an adverse impact upon cultural resources proportional to the amount and area of vehicular use that is located on archaeological sites.

As the existing parking and vehicle access area is on top of an archaeological site, continued use of this area for the same activities would result in further degradation of the cultural resources, eventually leading to total destruction of this major site. Beneficial impacts would accrue to the archaeological sites located within the enforced Closed area by eliminating vehicular use on top of the sites and restricting vehicular access for those intent upon illegal collection of artifacts. Vehicle trespass into the vehicle Closed areas would damage archaeological artifacts when present.

Social Resources

All recreation use of the dunes, but especially vehicle use, would bring some money, presently small amounts, into Owens Valley through the sale of dune buggy equipment to local residents, and food, lodging, and gas to recreationists passing through.

Conservationists and scientists would continue to deplore the possible degradation of the dune ecosystem. Vehicle enthusiasts would continue to use the area. Vehicle enthusiasts formerly unaware of the dunes might visit it after the present publicity.

The non-vehicle users can enjoy hiking and camping on the dunes at night in peace, safety from vehicles, solitude and relative silence. The vehicle users will not be able to enjoy the experience of running the dunes at night. Some dune buggies are equiped with headlights especially for night use.

Some non-vehicle users would have impaired dune experiences when vehicles are present. Creative sources for painting, photography, etc. would be impaired. Solitude would be destroyed for some when vehicles are in the area since silence is a generally accepted component of solitude. Scientific data on degradation rates would be impossible to collect without a control area of non-use. Practical information applicable to genetic manipulation, world food supply, erosion control, disease cures, etc. that might be gained from the endemic and highly adapted flora and fauna would be lost with the disappearance of each organism from the dune ecosystem and from the world species variety.

Pedestrian safety on the dunes would be threatened when irresponsible drivers of vehicles are using the dunes and in areas of marginal visibility, i.e., on either side of the crests. Vehicle users run the risk of injury voluntarily.

Management Resources

This alternative will require a management plan for recreation. Management should involve developing and maintaining facilities for camping and sanitation. A detailed management plan would be prepared. Interpretative displays could be developed. Maintenance requirements of facilities would be moderate during the use season. Necessity for enforcement of the Closed area designations would rise with an increase in user numbers during the recreation season.

2. Possible Mitigating or Enhancing Measures

a. Post the boundaries of the vehicle use areas to indicate where the "Closed to Vehicles" areas are. This should help to protect the habitat in the Closed areas.

b. Designate parking, picnic, and campground areas and their boundaries to prevent activities from spreading all along the base.

c. Develop sanitary facilities and garbage can locations.

d. Develop an interpretation center explaining the natural features of the dune ecosystem and ways in which recreation impacts the ecosystem. Include a display asking for thoughtful and conservative behavior.

e. Disallow vehicular use at night for environmental, aesthetic, and safety reasons as in the proposed action.

f. Establish and monitor additional photo trend plots and vegetative study transects both on the around the dunes. Establish and regularly monitor fauna population trend study transects.

g. Prior to implementation of this alternative all areas for vehicle access to the dunes should be intensively surveyed and salvaged by qualified professional archaeologists. Access areas should be clearly demarcated to confine vehicles to avoid impact to other cultural resources of the dune area. All camping and parking areas should be restricted to avoid impacting cultural resources. The number of points of vehicular access to the dunes should be kept to a minimum to lessen the adverse impact to archaeological remains. An interpretive signing program should also be used to discourage illegal collecting of artifacts and increase public appreciation of cultural values.

h. Establish a flexible ranger patrol program for the Eureka Dunes area to encourage compliance with the management plan.

3. Recommendations for Mitigation or Enhancement

All of the possible mitigation measures are recommended.

4. Residual Impacts

The air quality would be adversely impacted to a less than significant degree by this alternative.

The dune forms would be temporily loosened and broken. The moisture content of the dunes would continue to be impacted to an unknown degree. Off-dune vehicle use would continue to occur in the absence of a ranger, but the signs should eliminate innocent trespassing.

The dune vegetation, including the Endangered dunegrass, would lessen in vigor, population density, and numbers. The dune fauna would also lessen in density and abundance until the ecosystem would no longer be able to complete food chains and energy transfers.

Dune vehicular recreationists would continue to enjoy their ORV activities. Conservationists would continue to point to Eureka Dunes as yet another ecosystem lost to consumptive recreation. The recreation experiences of some non-vehicular users would continue to be impaired until it is likely that they would give up traveling to the dunes. According to letters from long-time non-vehicular dune users and former dune users some are staying away now to avoid the conflict (II.D.2.c.). This trend would continue and problems of management recognition of true public use desires could occur. (Badaracco, 1976)

Alternative A would cause residual impacts to archaeological artifacts proportional to the area of impact to cultural resources. All impacts to archaeological artifacts are residual.

B. Relationship Between Short-Term Use and Long-Term Productivity

Short-term use would be defined as that time in which the ORV recreation occurs on the dunes. This period would end if the dunes were ever closed to vehicles in the future. Long-term is that time in which subsequent effects of the recreation will still impact the environment. The same definitions apply to pedestrian activities.

The air quality would not be harmed on a long-term basis by this alternative. The dune geology and the playa would not be harmed on a long-term basis, nor would the long-term productivity of the lake sediments. The Endangered Eureka dunegrass would be severely impacted to the point of endangering the populations survival to a greater degree than is already occurring because of the limited habitat, distribution, and current vehicle recreation within that habitat. The four known endemic dune beetle species would possibly become extinct as continued vehicle use degraded the dune ecosystem. With continued and increased vehicle use, the total dune ecosystem would be greatly impaired and eventually effectively destroyed.

The short-term use for vehicular recreation would destroy some dune-edge archaeological remains - eliminating them from future scientific study and public interpretation.

C. Irreversible and Irretrievable Commitments of Resources

With increased vehicle use, this alternative would probably irreversibly commit to potential and probably extinction the Eureka dunegrass and at least four endemic species of dune beetles. A once flourishing dune ecosystem would be changed.

With the cessation of vehicular recreation after an unknown number of years, the ecosystem might repair, but it would be modified by the loss of these species and the setback in the successionary stage.

Any cultural resources damaged or destroyed would be permanently committed resources. These archaeological remains cannot ever be replaced or reconstructed.

ALTERNATIVE B. - VEHICLE USE, SOUTH HALF

Management Program

This alternative would open the south half of the dune area to all recreation uses, including vehicle use. All recreation uses, except vehicle use, would be permitted in the north half, from the highest, southernmost peak of the dunes northward. The south half of the dunes would be open to vehicles down to the base area. The portion of the Special Design Area from the base of the dunes eastward to the base of the Last Chance Mountains would be Closed to vehicular use except for the existing vehicle corridor from Eureka Valley to Saline Valley. (Fig. 14).

Significant Aspects

A reversal of the Proposed Action, Vehicle Use, North Half, this alternative also represents a compromise between conflicting uses of the dunes. All activities, except vehicle use, would be permitted on the northern portion of the dunes. Present vehicle use would be relocated to the southern portion of the dunes, a change from the general pattern of present use.

This alternative would probably be of less advantage to off-road vehicle users than would the proposed action of vehicle use north-half, since it would eliminate vehicle use on the long, steep slopes of the northern dunes. Other activities, such as hang-gliding might be adversely affected to the extent of their reliance upon vehicle use and the desirability of using the taller dunes of the north portion.

Some increase in BLM management activities in the dune area would be associated with this alternative, primarily to provide public health and safety and to enforce vehicle use restrictions.

1. Anticipated Impacts

Most impacts of Alternative B: Vehicle Use South Half, would be similar to those of the Proposed Action: Vehicle Use North Half, except that since the vehicle use areas are reversed, the locales of impacts are reversed. A few additional differences are as follows:

Human Values

Cultural Resources

The impacts to cultural resources from implementation of this alternative cannot be fully assessed at this time. The archaeological survey did not cover the base of the southern portions of the dunes. It is anticipated that the eastern side of the lower portions of the dunes may not contain the density and abundance of archaeological remains that is known to occur all around the northern half of the dunes. Archaeological

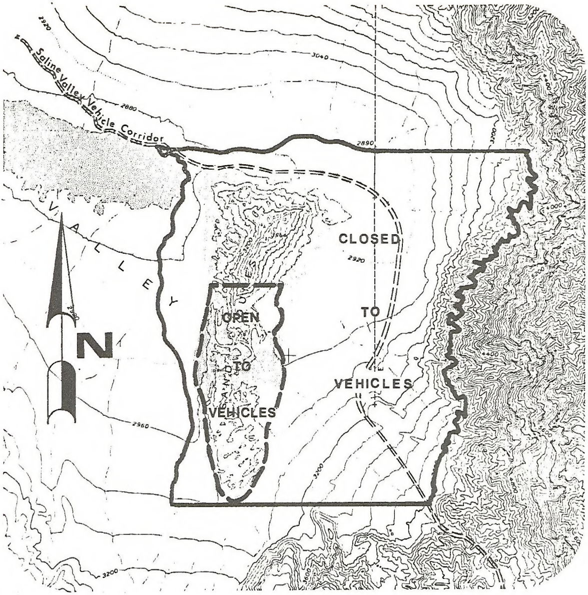


Fig. 14. Alternative B
Vehicle Use, South Half

—— Special Design Boundary

– – – Use Area Boundary

remains are highly likely to occur around the western side of the southern portion of the dunes. Negative impacts would be directly proportional to the amount of surface area containing archaeological sites that is subjected to vehicular use. New vehicle access would have to be created to the southern portion of the dunes. This would increase the potential for indirect negative impacts by illegal artifact collectors. Before the alternative could be implemented, a detailed archaeological survey of the southern portions of the dunes should be undertaken to ascertain exactly what cultural resources do exist, and what specific mitigative measures could be undertaken to preserve these resources.

Social Resources

Off-road vehicles would drive down to the south half to use the dune. However, as the high exciting peaks, slopes, and bowls are in the north half of the dunes, vehicle enthusiasts would be unhappy. Pedestrians would be able to carry out their activities on the north half near the parking area in relative safety and quiet when dune vehicles were present on the south half.

More of the ecological resources important to scientists, conservationists, and the dune system itself, have been reported to be more valuable on the north half (Letters to BLM). This alternative may provide more protection to the ecological resources than would Alternative C.

Management Resources

This alternative would require a Recreation Management Plan to be formulated by the Bureau. This alternative might require more ranger patrol than would Alternative C, because vehicle users would belikely to attempt to use the more valued (closed) area on the north end of the dunes.

2. Possible Mitigating or Enhancing Measures

a. Post the boundaries of the vehicle use areas to indicate the locations of the "Closed to Vehicles" areas. This should help to protect the habitat in the Closed areas.

b. Designate parking, picnic, and campground areas and their boundaries to prevent these activities from spreading all along the base.

c. Develop sanitary facilities and garbage can locations.

d. Develop an interpretative center to explain about the natural features of the dune ecosystem and ways in which recreation impacts the ecosystem. Include a display asking for thoughtful and conservative behavior i.e., please don't crush the vegetation.

e. Establish a gravel road from the present parking area down the west edge of the dunes to the north part of the south half to provide vehicular recreationists with a single route to their use area. Provide facilities for sanitation and camping at the road end.

f. Disallow night vehicular use for aesthetic, environmental and safety reasons; boundaries between the north and south half would not be seen at night, noise, etc.

g. Establish and monitor additional photo trend plots and vegetative study transects both on and around the dunes. Establish and regularly monitor fauna population trend study plots.

h. Prior to implementation of this alternative all proposed access areas to the southern portion of the dunes should be intensively surveyed for archaeological remains. Every effort should be made to develop access routes that avoid cultural resources. If no access route avoiding cultural resources can be located; then whatever route (or routes) that are selected should be intensively surveyed and salvaged by a qualified professional archaeologist.

i. A program of interpretive signing should be undertaken to discourage pothunting.

3. Recommendations for Mitigation or Enhancement

All of the possible mitigating measures are recommended.

4. Residual Impacts

The air quality would be adversely impacted to a less than significant degree by this alternative. The dune forms would be temporarily loosened and broken by vehicles on the south portion. The moisture content of the dunes may continue to be impacted to an unknown degree on the north half. Off-dune vehicular trespass and vehicular trespass into the north end of the dunes would continue to occur but the signs should eliminate the innocent trespassing activities.

With continued and increased vehicle use, the vegetation and fauna on the south end would decline in vigor, population density, and numbers until the ecosystem could simplify to the point that food chains and energy transfer processes are filled by substitute species.

Dune vehicular recreationists would continue to enjoy their ORV pursuits on the south portion but would not be able to use the more desirable north half. Conservationists would continue to point to Eureka Dunes as an ecosystem compromised for the sake of consumptive recreation. The recreation experiences of some non-vehicular users would continue to be impaired on the south half. Archaeological resources would be residually impacted wherever adverse impacts occurred.

B. Relationship Between Short-Term Use and Long-Term Productivity

Short-term use would be defined as that time in which recreation occurs on the dunes. This period would end if the dunes were closed in the future. Long-term is that time in which residual effects of the recreation will still impact the environment.

The air quality would not be harmed on a long-term basis by this alternative. The dune geology and the playa surface would not be harmed on a long-term basis, nor would the long-term productivity of the lake sediments be significantly harmed.

If ORV use continued or increased commensurate with estimated increases for the total desert, the Endangered Eureka dunegrass could be exterminated on the south half of the Eureka Dunes, leaving the population on the north half and a marginal population in Marble Canyon. If those populations were not sufficient to maintain the species, the dunegrass could become extinct in the wild. The four known endemic dune beetles could also suffer a population loss on the south half. The ecosystem would be greatly impaired and changed on the south half.

The short-term use for vehicular recreation would destroy some dune-margin archaeological remains that may be present, eliminating them from future scientific study and public interpretation.

C. Irreversible and Irretrievable Commitments of Resources

If the gene pools and water supplies of the dunegrass and endemic beetles were sufficient to maintain these species on the north end and in Marble Canyon, these would not be irreversibly committed. If they were not large enough, and the populations declined, then these organsims could be irreversibly committed.

Any cultural resources damaged or destroyed would be a permanent commitment of resources. These archaeological remains cannot ever by replaced or reconstructed.

ALTERNATIVE C: Recreation, Non-Vehicle (Outstanding Natural Area)

Management Program

Under this alternative the Eureka Dune Special Design area would be opened to all recreation uses except for the use of off-road-vehicles. The existing vehicle corridor from Eureka Valley to Saline Valley would be retained. Road access would be terminated at designated parking areas just north of the dunes (Fig. 15).

Alternative C would designate the Eureka dunes as outstanding natural area, to preserve the scenic values and natural wonders. The preservation of these resources in their natural condition is the primary management objective.

Significant Aspects

This action will emphasize non-vehicle recreation use of the Eureka Dunes and the surrounding area. The dunes will be accessible by auto, but auto access camping will be allowed only at designated sites just north of the dunes. No use of off-road vehicles will be allowed except on designated roads.

All non-vehicular recreation activities will be allowed. Some increase in BLM management activities will probably be necessary, particularly to provide sanitation and to enforce vehicle restrictions.

A. Environmental Impacts

1. Anticipated Impacts

Air

The exhaust fumes from the vehicles used to travel to the dunes will be added to the air basin but This will represent an insignificant degree of pollution unless user numbers rise exponentially. Exact amounts of potential pollution are unknown.

Geology

As long as vehicles remain on designated routes and in designated parking areas, there will be no adverse impacts. Off-road vehicle travel onto any of the Special Design Area will leave tracks and compact the soil to varying intensities (See Alternative A: Vehicle Use).

Flora

This alternative would allow vegetation which may currently be suffering on the dunes because of vehicle pressure to become reestablished. Pedestrian activities would still impact the flora but not to the same degree as would vehicles.

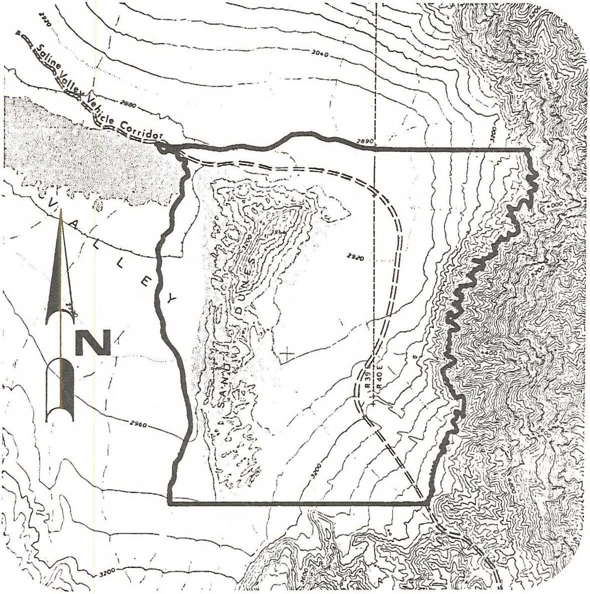


Fig. 15. Alternative C (Outstanding Natural Area)

Recreation, Non-Vehicle

——— Special Design Boundary

— — — Use Area Boundary

Fauna

The faunal populations would increase in density and possibly diversity to approach pre-vehicular equilibrium. This will correspond somewhat to vegetative recovery, especially for species like the kangaroo rat. Fauna would no longer be harassed by dune vehicles. When active, they would dodge pedestrians and would not risk potential deafness from pedestrian noise as they may have suffered as the result of vehicle noise. Pedestrians do collapse burrows, and step on inactive lizards, snakes and insects under the surface of the sand. Faunal habitats around the campgrounds may continue to have low carrying capacities because of the denuded vegetation. Species that are adaptable to campground environments and amenable to the additional food sources campers represent would inhabit these areas.

Ecosystem

The components of the ecosystem would begin to increase in density and diversity and eventually reach the presently unknown pre-vehicle use equilibrium. The ecosystem would regain pre-vehicular food webs and relative energy flow paths.

Human Values

Cultural Resources

Assuming designated parking and camping areas would be located in areas devoid of cultural resources, the alternative would have a directly beneficial effect on archaeology by eliminating vehicle damage to sites.

It would also restrict vehicular access to sites by those who engage in illegal collection of artifacts. However, any increase in visitors to the dune area could result in increased illegal collecting activity. Trespass of vehicles into vehicle Closed areas would damage archaeological resources the vehicles might encounter.

Social Resources

The cessation of off-road vehicle activities in the Eureka Dunes Special Design Area could cause a slight decrease in the amount of recreationist money flowing into the Owens Valley. However this decrease might be offset by increases in numbers of non-ORV dune activities.

Conservationists and scientists will be pleased that the unique Eureka dunes will be protected. Vehicle enthusiasts would lose a vehicle area which is convenient to the dune enthusiasts of the Owens Valley. The ORV enthusiasts would be displaced to another area or denied their recreational pursuits.

The area would support a range of multiple uses, from various pedestrian activities to scientific research. These uses should not have serious inherent conflicts. Pedestrian safety would no longer be endangered by dune vehicles.

Management Resources

A Recreation Management Plan would be developed for the Special Design Area. Management would be needed to develop and maintain sanitary and camping facilities and interpretive displays. Rangers might have to patrol heavily during the first use season to enforce the closure, until dune vehicle enthusiasts realize that the decision is being enforced. They then would probably cease coming to the area, and enforcement intensity could lessen.

2. Possible Mitigating or Enhancing Measures

a. Post the boundaries of the vehicle use areas to indicate the location of the "Closed to Vehicles" areas. This should help to protect the habitat in the closed areas.

b. Designate primitive parking and campground areas and their boundaries, to prevent these activities from spreading all along the base of the dunes.

c. Develop sanitary facilities, place garbage cans, and develop a maintenance schedule.

d. Develop an interpretative center to explain the natural features of the dune ecosystem and ways in which recreation impacts the ecosystem. Include a display asking for thoughtful and conservative behavior.

e. Establish and monitor additional photo trend plots and vegetative study transects both on and around the dunes. Establish and regularly monitor faunal population trend study transects.

f. All designated camping and parking areas should be intensively surveyed for cultural resources prior to designation. Areas selected should be devoid of cultural resources. Carefully worded interpretive signs should be used to discourage the illegal collection of artifacts and help to increase public appreciation of the cultural environment of the study area.

g. Establish a flexible ranger patrol program for the Special Design Area to encourage compliance with the management plan.

3. Recommendations for Mitigation or Enhancement

All of the above measures are recommended.

4. Residual Impacts

The varied pedestrian activities will have some negative impacts on the flora and fauna and the dune ecosystem carrying capacity, especially in and around the campgrounds and parking lots to be designated in the Recreation Management Plan.

Residual impacts of the proposed action in terms of archaeology should be minimal. However, any human use of the area leaves room for the possibility of vandalism to archaeological sites from illegal collection, and the vehicular trespass activities of those who do not wish to follow the management plan can cause irrepairable damage to cultural resources. Net residual impacts of the plan cannot be completely determined at this time.

B. Relationship Between Short-Term Use and Long-Term Productivity

Short-term use would be defined as that time within which recreation occurs on the dunes. This period would end if the dunes were ever closed to recreation in the future. Long-term is that time in which subsequent effects of the recreation will still impact the environment.

Long-term productivity of the flora and fauna should not be adversely affected by the short-term use for pedestrian recreation. The alternative should be adversely impact the quality and quantity of the ecosystem's long-term productivity.

The short-term use of the area by people for recreation and/or research may have some effect on the archaeological resources. Even removal of archaeological remains for scientific study constitutes destruction of the resource, by making it unavailable for on-site study in the future, when more sophisticated methods of extraction and analysis may be developed. Any use that destroys or damages any portion of the site decreases the long-term productivity of these sites in terms of the scientific information they can yield and the interpretive potential they contain.

C. Irreversible and Irretrievable Commitments of Resources

There will be some individuals of the floral and faunal communities that will be irreversibly and irretrievably committed by this alternative, but less damage and destruction to these communities will result from this alternative than from the alternatives allowing vehicle use.

Any activity that will damage or alter cultural resources will eliminate some fragment of scientific data. As long as the destruction is minimal the commitment of archaeological resources will be minimal. However, these resources are completely non-renewable. The archaeological remains that occur in the study area cannot be reconstructed. Any loss of archaeological data is a permanent, irreversible and irretrievable loss.

ALTERNATIVE D. - ORV USE BY PERMIT

Management Program

The alternative regulates the intensity of off-road vehicle (ORV) use throughout the dune system through the use of a permit system, and manages the Special Design Area as a Research Natural Area (43 CFR 6225). The dunes would remain open to vehicle use down to the base area. The portion of the Special Design Area from the base of the dunes eastward to the base of the Last Chance Mountains would be Closed to vehicular use except for the existing vehicle corridor to Saline Valley. (Fig. 17)

Significant Aspects

This alternative would emphasize non-vehicular recreation and other uses, but would allow limited vehicle use by permit in an attempt to mitigate adverse effects on either the dune environment or on other human activities. Non-vehicular types of activities, such as those related to hiking, nature study and research, or the enjoyment of solitude would not require permits and would benefit from controlled vehicle numbers. Present levels of activity for unique or novelty uses, such as hang-gliding or search and rescue training, would probably not be affected. Increases in such activities as these, which are somewhat dependent upon the use of a vehicle for their accomplishment, would be limited by the amount of vehicle use that could be allowed under the permit system.

Increased management by the BLM could be expected under this alternative, both with regards to public health and safety and, in particular, with regards to enforcement and management of the vehicle permit system.

1. Anticipated Impacts

Air

Alternative D: ORV Use by Permit would contribute auto exhaust components to the Eureka Valley airshed. Amounts contributed, however, would not be significant. Dune vehicle numbers would be controlled so that large increases in use would not occur.

Geology

The impacts of vehicle use on the dune formation would be similar to Alternative A: Vehicle Use, but only to a slight degree, because numbers would be controlled by the permit system. Impacts on the playa, alluvial fans, and ancient lake terraces, would presumally be minimal, because, in order to administer the permit system a ranger would be present during use periods and would be able to prevent trespass into the closed areas.

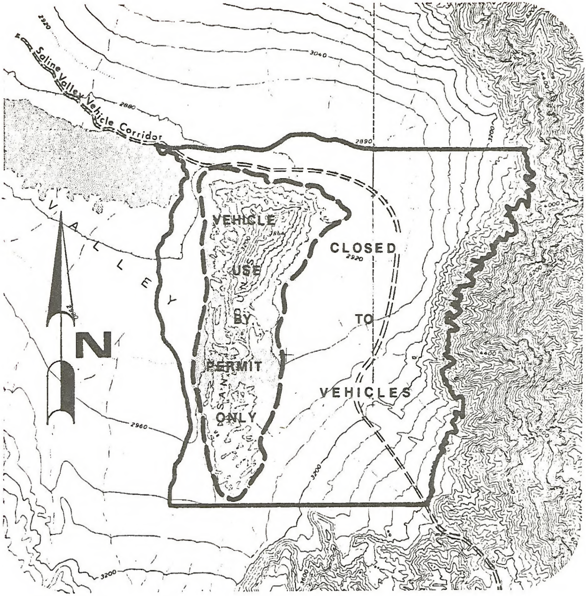


Fig. 16. Alternative D

ORV Use By Permit

━━━━━━ Special Design Boundary

━ ━ ━ ━ ━ Use Area Boundary

Flora

The dune vegetation might be adversely impacted by this alternative. It is possible that the initial established limits on vehicle use per day would be too high for the vegetation to withstand. However, numbers of vehicles permissible would be determined by a careful watch on the vegetation. If damage became apparent, vehicle numbers could accordingly be further restricted.

Fauna

The dune dwelling fauna could be impacted by this alternative during the initial determining vehicle use level period. A subsequent readjustment to lower levels of use or exclusion of vehicles would allow most of the fauna species to recover. None of the species are adapted to vehicle pressure. Some species, especially the endemic beetles, might be impacted to such a degree by present use and by the use levels attained with time and demand under the permit system, that the populations would not be able to recover. When vegetation recovered after lower use levels would be initiated, or use was terminated, species like the kangaroo rat would slowly recolonize to a degree dependent upon the new lower vehicle use levels. Any level of vehicle use would cause a lower carrying capacity for the ecosystem. Original pre-vehicle capacities will never be known, and although visual determiniations of dune integrity may indicate to some that the present use levels are not detrimental, we will not know because baseline fauna and flora data is lacking.

Ecosystem

Vehicle use at any level would be detrimental to flora and fauna. The significance of a lowered carrying capacity of the dune ecosystem would have to be weighed against the social benefits of vehicle use.

Human Values

Cultural Resources

The negative impacts to archaeological resources would be directly proportional to the intensity of ORV use gaining access to the dunes. All areas around the base of the northern one half of the dunes contain archaeological resources. Therefore, any vehicular access to the dunes will probably impact some cultural resources. No indirect impacts are anticipated as a result of this alternative.

Social Resources

Impacts to social resources would be similar to Alternative A: Vehicle Use. Some non-vehicular dune users would have their experiences impaired, to an extent depending upon the total vehicle use allowed.

Management Resources

Management would involve all facilities and maintenance that were mentioned in Alternative A: Vehicle Use. In addition, a permit station/ interpretive center might be necessary. Ranger patrol would be necessary to insure compliance with boundaries, and number controls would be necessary for peak use periods. Conceivably in the future, if Eureka Dunes became as popular as some wilderness areas are now, all uses would require permits to ensure dune ecosystem integrity. Presently, it is considered necessary to limit only ORV use which has the highest adverse impact per capita (as per this alternative).

2. Possible Mitigating or Enhancing Measures

a. Post the boundaries of the vehicle use areas to indicate where the "Closed to Vehicles" area are. This should help to protect the habitat in the Closed areas.

b. Designate primitive parking, picnic, and campground areas and their boundaries, to prevent impacts from these activities from spreading all along the base of the dunes.

c. Develop sanitary facilities and place garbage cans.

d. Develop an interpretive center to explain the natural features of the dune ecosystem and ways in which recreation impacts the ecosystem. Include a display asking for thoughtful and conservative behavior.

e. Disallow vehicular use at night for environmental, aesthetic and safety reasons.

f. Establish and monitor additional vegetative photo trend plots and vegetative study transects for all dune species both on and around the dunes. Establish and monitor fauna population trend study plots.

g. Prior to implementation of this alternative all areas for vehicle access to the dunes should be intensively surveyed and salvaged by qualified professional archaeologists. Access areas should be clearly demarcated to confine vehicles to avoid impact to other cultural resources of the dune area. All camping and parking areas should be restricted to avoid impacting cultural resources. The number of points of vehicular access to the dunes should be kept to a minimum to lessen the adverse impact to archaeological remains.

An interpretive signing program should also be used to discourage illegal collecting of artifacts and increase public appreciation of cultural values.

h. Issue permits only on certain weekends and holidays, leaving some weekends and holidays for non-vehicular use.

3. Recommendations for Mitigation or Enhancement

All of the possible mitigative measures are recommended.

4. Residual Impacts

The air quality would be adversely impacted to a less than significant degree by this alternative.

The dune forms would be temporarily loosened and the surface broken by vehicles to a lesser degree than Alternative A. The moisture content of the dunes may continue to be lessened to an unknown degree. Off-dune trespass could continue to occur in the absence of a ranger, but the signs should eliminate innocent well-meaning trespassing.

Ultimately, a vehicle use level will be determined that will allow a stable vegetative and faunal community. Cultural resources would be residually impacted wherever contact occurred.

B. Relationship Between Short-Term Use and Long-Term Productivity

Short-term use would be defined as that time in which ORV and pedestrian recreation occurs on the dunes. This period would end if the dunes were ever completely closed to vehicles and pedestrians. Long-term productivity is defined by the term of time required for the environment to recover from short-term use.

The air quality would not be harmed on a long-term basis by the adoption of this alternative. The dune geology and the playa surface would not be harmed on a long-term basis, nor would the long-term productivity of the lake sediments be harmed.

Use levels under Alternative D would be controlled sufficiently to allow at least a modified ecosystem to remain. Consequently, the ecosystem should be able to build up to former pre-vehicular carrying capacity or productivity if vehicle use ended. The restored ecosystem would probably not be identical to the former one in terms of food webs and energy transfers.

Short-term use for vehicular recreation would destroy some archaeological remains, eliminating them from the long-term productivity of future scientific study and public interpretation.

C. Irreversible and Irretrievable Commitments of Resources

If management is carried out as planned, only cultural resources would be irreversibly and irretrievably committed. Any cultural resources damaged or destroyed would represent a permanent commitment of resources. Archaeological remains cannot ever be replaced or reconstructed.

ALTERNATIVE E: RESEARCH BY PERMIT

Management Program

Under this alternative the BLM would manage the Special Design Area for the sole purpose of scientific study and research. The area would be dengnated as a Research Natural Area (43 CFR 6225) and only scientific research that would not be repetitive, or cause significant harm to the dune ecosystem would be allowed by permit. All other uses would be restricted (Fig. 17).

Significant Aspects

This alternative would emphasize those values that could be attained by scientific research on and around the Eureka Dune system. Considerable public interest has been expressed concerning the flora, fauna, geologic, and hydrogeologic attributes of the Eureka Dune system. Opportunities also exist for archaeological research. In all, the Eureka Dunes and the surrounding area represent a unique and valuable scientific resource, which would be protected from adverse impacts from all other human activities by the implementation of this alternative.

Management activities by the BLM could be expected to increase under this alternative, particularly in administration of the permit system to ensure resource protection from possible large numbers of research projects and in efforts to enclude all but researchers. Research on the two Endangered plants will fall under the proposed General Permit Procedures and Endangered and Threatened Wildlife and Plants published in the Federal Register, Vol. 41, No. 110 June 7, 1976.

1. Anticipated Impacts

Air

Researchers travelling by automobile to the Eureka Dunes research area would contribute insignificant amounts of pollution to the air basin.

Geology

The dune integrity would not be adversely affected by research under permit. Playa, lake sediment, and alluvial fan integrity would not be adversely impacted to any significant degree. Compaction and permeability tests might be carried out, but not over wide areas.

Flora

No adverse impacts will occur from research on the Special Design Area. Beneficial recovery from vehicles of the flora will occur over time. Over-collecting is a possibility.

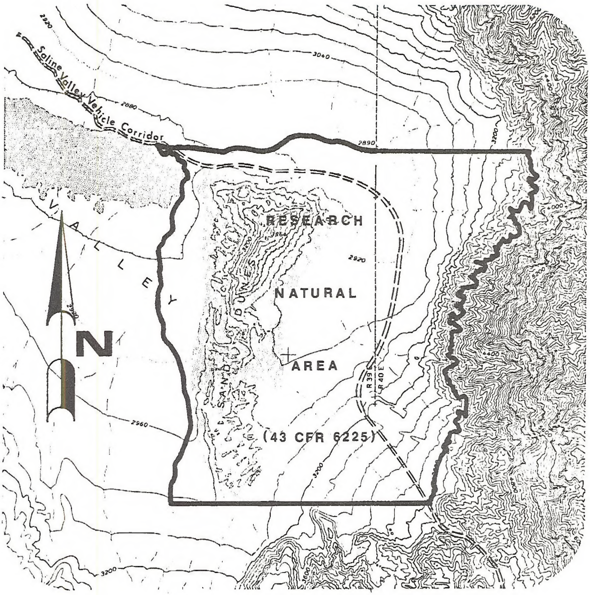


Fig. 17. Alternative E
Research By Permit

━━━━━━━ Special Design Boundary

━ ━ ━ ━ ━ Use Area Boundary

Fauna

No adverse impacts will occur from research in the area. Beneficial recovery of the fauna will occur over time. Recovery rates of flora-dependent fauna would be determined by recovery of the flora. Over-collecting is a possibility.

Ecosystem

The ecosystem would not be adversely impacted by scientific research. It would benefit from the cessation of vehicular and pedestrian use. Recovery rates are unknown but flora and fauna that are missing in their pre-vehicular locations, densities, and relative abundancies would perhaps return, perhaps with unexpected distributions and densities.

Human Values

Cultural Resources

This alternative would have a beneficial impact on cultural resources except that it would restrict archaeological research by non-professional archaeologists. Antiquities permits are already required for most types of archaeological research (all research involving alteration or collection of the resources). Only professional archaeologists can qualify for antiquities permits. Many amateurs working only with what they can see on the surface and record on paper and in photographs have contributed much valuable information to the field of archaeology. Eliminating their work in this area could have a negative effect on the field of archaeology in general. However, this is not anticipated to be a significant negative effect as no legitimate amateur archaeologists (known to the BLM) are working at the area at this time.

Social Resources

Money flowing into the Owens Valley from Eureka Dune recreational users would stop.

All present dune users would lose social, mental, physical, and emotional benefits currently derived from use of the dunes. Non-professional scientists would not be allowed to study the dunes. Conservationists would probably be pleased that the dunes are protected, but upset that they would not be allowed to enjoy them. Vehicle enthusiasts would be irate. All other users also would be upset. The recreation resource offered by the dunes would not be utilizable under this alternative. However, research under undisturbed conditions would contribute to mans knowledge of genetics, adaptablility, dune ecology, native American history, and other subjects.

Management Resources

Management would involve initiating and administering the permit system and enforcing of the closure. Trespass would occur, ranging from casual use in innocence of the full meaning of the signs, through use in the belief that the closure "must apply to someone else, not me, I don't hurt the dunes," to vindictive destructive trespass in revenge, examples of which currently occur when Bureau signs are destroyed.

2. Possible Mitigating or Enhancing Measures

a. Post the boundaries of the Vehicle Closed area.

b. Establish a review board composed of members of the scientific community and Bakersfield District BLM employees to determine the relative suitability and environmental impact of each proposed project, prior to issuing a permit. The board would review research plans and attempt to insure that no two scientific studies duplicate data or in any way interfere with each other, or with the integrity of the dune ecosystem.

c. Amateur archaeologists could be granted special permits to observe and study in situ (on the ground) the archaeological remains of the Eureka Dune area. This would allow these people to study the archaeological materials without disturbing or destroying them. Careful control would have to be maintained to assure that the permits were being utilized properly and not as licenses to collect.

d. Amateur scientists, self-trained botanists, biologists, etc., could be granted special permits to conduct research in the area.

3. Recommendations for Mitigation or Enhancement

All of the above possible mitigation measures are recommended.

4. Residual Impacts

No adverse residual impacts should occur under this alternative.

B. Relationship Between Short-Term Use and Long-Term Productivity

The short-term use would be defined as that time in which the research occurs on the dune area. This period would end when each project finishes and collectively when the research permits are no longer issued and all studies have been completed. Long-term productivity relates to that time in which residual effects of the research would still impact the environment.

There would be no lessening of the dune productivity as a result of research projects permitted by the Bureau.

C. Irreversible and Irretrievable Commitments of Resources

No resources will be irretrievably or irreversibly committed as a result of this alternative, unless permits are issued to excavate archaeological sites. If this occurs, there resources will be irretrievably committed, but compensative benefits will accure in the form of additions to archaeological knowledge of the area.

IV. PERSONS, GROUPS AND GOVERNMENTAL AGENCIES CONSULTED

In November of 1974, a committee was formed with the expressed purpose of preparing a management plan for the Eureka Dune Special Design Area. Membership of the committee consisted of Mary DeDecker, Bishop, CA (Botany); John Mawby, Deep Springs College (Geology); Mel Dougherty, Bishop, CA (Off-road vehicles); Carol Thorne, Bishop, CA (Off-road vehicles); and Moe Jacobson, Bishop, CA (Recreation, business). The first meeting of this committee took place on December 5, 1974.

Subsequent to the December, 1974 meeting, three more committee meetings were held (Appendix B). Concurrently, with these meetings, news releases were distributed and informational articles were published in the local Bishop newspaper. At the final committee meeting, held in September, 1975, a list of ten vehicle management options, or alternatives, were presented to the committee for its review (Appendix C). The committee did not reach a consensus as to the management approach that would be most desirable.

On December 2, 1975 a public Open House/Workshop was held in Bishop to discuss the management alternatives available for the Eureka Dunes. A draft plan, developed upon a basic compromise between conflicting values and philosophies for managing the dunes was prepared after this meeting and was distributed for public review in February, 1976. By the end of the review period, June 1, 1976, a total of 596 responses had been received. The responses indicated a near even division between complete closure and complete opening of the dunes with a minority supporting a compromise. Approximately 18% of the letters requesting closure was written by 10 individuals.

In addition to the above mentioned persons, the following have been contacted with specific regards to the Eureka Dunes management plan and/or the Environmental Analysis Report.

Allied Senior Citizens
Bishop Womens' Improvement Club
Inyo County Board of Supervisors
Owens Valley Interagency Committee
Bishop High School
Bakersfield District Multiple Use Advisory Board
Bishop Chamber of Commerce
Derham Giuliani, entomologist
Congressman William Ketchum
Howard G. Wilshire, geologist
Rollin and Grace Enfield, Bishop, CA, archaeologists
Herrick E. Hanks, Archaeologist, Desert Plan Staff, BLM
Ruth D. Simpson, Archaeologist, San Bernardino Co. Museum
Jenny Schumaker Smith, Palo Alto, CA
Inyo County Planning Commission
Robert C. Stebbins, U. C. Berkeley

V. INTENSITY OF PUBLIC INTEREST

There appears to be a fairly high level of public interest in future management of the Eureka Dunes. As is shown in Appendix D, this interest is essentially divided between those persons or groups who would have the dunes open to ORV-oriented recreation, and those who would have the dunes open to non-vehicular recreation or scientific study. As could be expected in an area such as this, which is relatively small in size, few people in general expressed a willingness to significantly compromise their basic positions. This is understandable, as the number of trade-off options are rather limited.

Essentially, public interest in the area has been expressed in the form of correspondence. A limited number of key individuals or interest group representatives have made personal contact with either the Area Manager or the District Manager, but such has not been the case, to any great extent, with members of the general public.

Public attendance at the December, 1975, Open House/Workshop was good, although attendance at the March 11 and 13, 1976 field trips was sparse, especially when compared to the volume of correspondence. A number of participants had previously been in contact with the Area Manager to discuss development of the management plan. Considerable discussion concerning the draft plan took place at the March 25 and 26, 1976 District Advisory Board meeting, but, again, most comments were made by those who had already provided significant input.

Most interest appears to have been generated by circulation of the draft proposal. This seems to have provided a focal point, particularly for those persons geographically separated but sharing common interests, or those who were members of organized groups located some distance from the Owens Valley. At this point in time, there is no data other than as stated by respondants, to indicate whether or not these persons are a significant percentage of actual users of the area.

VI. PARTICIPATING STAFF

Janis L. Bowles, District Ecologist Co-Team Leader	Impact Analysis
Richard Conrad, Outdoor Recreation Planner - Co-Team Leader	Existing Environment
John S. Mooneyham, Planning/Environmental Coordinator	Description Proposed Action and Alternatives, Figures and maps.
Larry Mangan Wildlife Biologist	Wildlife
Brad Hines, Range Conservationist	Vegetation

Douglas McFarland, Geologist	Geology and soils
Dave Worley, Draftsman	Maps and Figures
Lynn Deuerling, Clerk-Typist	Typing

VII. SUMMARY CONCLUSION

Management success is the key to the accurate analysis of impacts. The residual impacts of vehicle use will be partial or complete elimination of vegetation, flora, and ecosystem processes on the dunes. Residual impacts of non-vehicle recreation will be a slight lowering of the carrying capacity of the dune ecosystem on a long-term temporary basis.

The relationship between short-term use of vehicles and long-term productivity of the ecosystem is that vehicles will lower the long-term productivity and may permanently change the energy transfer processes within the system. Non-vehicular activities will not significantly harm long-term productivity.

If the endemic species of flora and fauna are eliminated by recreation, they are irreversibly committed to satisfy a short-term use of recreation. Other resources should not be irretrievably committed to recreation, either vehicle or non-vehicle, if management efforts are successful.

Public interest has been high. Opinions range from advocating closure of the dunes to all use or just to vehicles, to advocating opening the dunes to unlimited vehicle use. The expression of public opinion has mainly been by letter from persons living varying distances from the dunes. The nature of the responses has ranged from the offering of analytical scientific data, or of scientific data backed by emotional responses, to unemotional offerings of all ranges of opinion, to emotional opinion offerings usually advocating opening the dunes to recreation vehicles or completely closing them to vehicles.

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APPENDIX A

Vehicle Counts and Points of Origin
March, 1970 to April 1976

Date	Vehicles	Residence
3/20-21/70	23	16-Bishop, CA 2-Big Pine, CA 2-Sparks, NV 1-Davis, CA 1-Plymouth 1-Lebonon, Oregon
4/3-4/70	26	9-Novato, CA 4-Bishop, CA 3-Sacramento, CA 2-Reno, NV 2-Rancho Cordova, CA 1-Pullman, Washington 1-Placerville, CA 1-Oakland, CA 1-Carmichael, CA 1-Fair Oaks, CA 1-Mesa, Arizona
Easter/71	24	10-Bishop, CA 4-Anaheim, CA 4-Big Pine, CA 2-Sparks, Nevada 2-Redondo Beach, CA 1-Los Angeles, CA 1-El Cajon, CA
5/8-9/71	16	6-Bishop, CA 5-Deep Springs, CA 4-Long Beach, CA 1-Westways Photographers
Thanksgiving/71	28	11-Bishop, CA 3-Burbank, CA 2-Hollywood, CA 2-Culver City, CA 2-Oxnard, CA 2-Port Heneme, CA 1-Valencia, CA 1-Grnanda Hills, CA 1-Anaheim, CA 1-Carmichael, CA 1-Ventura, CA 1-Independence, CA

Date	Vehicles	Residence
1/16/72	16	16-Bishop, CA
1/23/72	6	6-Bishop, CA
2/19-21/72	29	15-Bishop, CA 10-China Lake, CA 3-Mammoth, CA 1-Loma Linda, CA
Easter/72	37	26-Bishop, CA 6-Santa Maria, CA 1-Santa Monica, CA 1-Chino, CA 1-Carmel, CA 1-El Cajon, CA 1-Redondo Beach, CA
2/17-19/73	25	15-Bishop, CA 5-Mammoth, CA 1-San Luis Obispo, CA 1-Death Valley, CA 1-Middleton 1-La Habra, CA 1-Moscow, Idaho
Easter/73	92	52-Bishop, CA 8-Mammoth, CA 6-Fair Oaks, CA 3-Carmichael, CA 3-Loomis, CA 2-Orangeville, CA 2-Oakland, CA 2-San Francisco, CA 2-Citres Heights, CA 2-Van Nuys, CA 2-Alhambra, CA 1-Redonda Beach, CA 1-Plymoth 1-Long Beach, CA 1-Palmdale, CA 1-Sacramento, CA 1-Big Pine, CA 1-Sierra Madre, CA 1-Temple City, CA

The above information was supplied by Carol Thorne, Bishop, California.

These vehicle counts were recorded by an ORV user while pursuing her activity at the Eureka Dunes on weekends and holidays. The samples represent heavy use time periods. This assumes the ORV recorder visited the dunes at the most desirable or opportune time when most other ORV users would also use the area. This coincides with the most favorable climatic conditions at the dunes giving a heavy use season from November to May for both ORV and non-ORV users.

If the samples are representative of heavy use weekends and holidays the following can be deducted.

Number of Vehicles During Heavy Use Time Periods

	Average Weekend	Average Holiday
1970	25 vehicles	- -
1971	16 vehicles	26 vehicles
1972	17 vehicles	37 vehicles
1973	25 vehicles	92 vehicles

From this it may be concluded that there was an increase in users from 1970 to 1973 on holiday weekends. The average weekend use appears fairly constant.

Appendix A-1

BLM Aerial Vehicle Counts
April 1974 - April 1976

Date	Vehicles	Dune Buggies
4/7/74	10	
4/12/74 (Easter)	24	
4/21/74	3	
5/26/74 (Memorial Day)	42	
4/6/74	6	
7/21/74	1	
8/4/74	0	
9/22/74	0	
10/6/74	0	
10/20/74	3	
11/2/74	2	
11/10/74	5	
11/30/74 (Thanksgiving)	24	
12/8/74	1	
12/30/74	1	
2/16/75	24	
3/23/75	0	
8/31/75	6	6
9/20/75	0	
10/7/75	0	
10/19/75	2	

10/27/75	3	3
11/16/75	12	4
11/29/75 (Thanksgiving)	6	2
12/9/75	0	
1/16/76	1	
2/15/76	13	2
2/22/76	9	2
2/25/76	0	
3/24/76	0	
4/17/76	48	1
4/21/76	1	

(Information obtained from BLM aerial surveys)

From the random BLM aerial flights, 1974-76, the following can be deducted.

Average Number of Vehicles on

	Weekend During Busy Season	Weekend During Non-Busy Season
1974	4	1
1975	12	1
1976	9	- -

	Holiday During Busy Season	Holiday During Non-Busy Season
1974	30	6
1975	15	3
1976	31	- -

The following shows the trend from 1970 to 1976:

	Average Number of Vehicles on Heavy Use Weekend	Average Number of Vehicles on Holiday During Heavy Use Season
1970	25	--
1971	16	26
1972	17	37
1973	25	92
1974	4	30
1975	12	15
1976	9	31

It may be concluded that the heaviest use occurred from 1970 to 1973. The use peaked in 1973 and has been tapering off since. Aerial flights show that weekday use is minimal and that November to May is the busiest season.

However, the samples are insufficient, and the two types of survey techniques may account for the differences. (i.e., the aerial flights equal a spot check while the counts from 1970 to 1973 were on the ground surveys for the entire time.

APPENDIX B
EUREKA SAND DUNE SPECIAL DESIGN

Public Participation Plan

	Action	When
1.	Issue and group identification (committee selection)	11/11/74
2.	First meeting of committee (introduction)	12/5/74
3.	News release about first meeting and public participation effort.	12/12/74
4.	Second meeting of committee (on-sight examination of dunes)	1/11/75
5.	News release about second meeting	2/6/75
6.	Third meeting of committee (alternative management recommendations - 26 letters of recommendation on management).	2/27/75
7.	News release about third meeting and continued public participation	3/27/75
8.	Informative series of articles in local paper: a. Introduction - Wildlife b. Flora c. Geology - Recreation	 4/25/75 5/8/75 5/29/75
9.	Informative slide presentation with groups requesting additional information: a. Inyo County Supervisors b. High School ecology class c. Senior Citizens	Upon Request
10.	Resource studies: a. Small animal b. Vegetative trend c. Recreational use	3/75 -- continuing
11.	News release on fourth committee meeting	8/28/75
12.	Fourth meeting with committee (BLM presents entire range of alternatives to committee for their final comment - open to public).	9/75

13. News release on fourth meeting on open house	9/75
a. News Release on Open House	11/12/75
14. Open house/workshop (Informational/public drop-in anytime) (Committee present at an evening session for question-answers).	
15. Draft Plan (Circulated to interest groups and public)	2/76
16. Written comments on draft plan	3/76
17. News Release - Management Plan	2/23/76
18. News Release on field trip	2/27/76
19. News Release on field trip	3/8/76
20. Newsbeat - Proposed Plan	3/76
21. Field Trip	3/11 and 13/76
22. Start work on EAR	4/1/76
23. Distribute EAR for Public Review	7/15/76

APPENDIX C

EUREKA SAND DUNES SPECIAL DESIGN

Vehicle Management Alternatives

1. Open area.
2. Close area.
3. North half open to vehicle use - south half closed. Division line located south of (southern-most) high peak.
    a. Division line located north of (southern-most) high peak.
    b. Open east half of dry lake bed.
4. West half open to ORV use.
East half closed. Division line crest.
5. Closed from January 1 to May 1.
6. Open May 1 to February 1.
7. Permit Area - Quota on ORV use.
8. Restrict ORV night use.
9. Allow competitive ORV use on Open portion.
10. Disallow competition on dunes.

APPENDIX D
EUREKA SAND DUNES
PUBLIC PARTICIPATION ANALYSIS

OPEN	COMPROMISE	CLOSE
General Public		
Before Proposal - 32	6	95
No motorcycles	Orderly restrictions	Remainder existing Roads & Trails
Limit # of ORVs on holidays	Open portion - close rest	Add to D. V. National Monument
	Limit ORV - No night use or competition. Existing R & T's, plus studies.	Natural Area Studies needed primitive area
	Close base - No night use, monitor.	
	Divided at swale (N.open; S.Closed - designated remainder).	
After Proposal - 217	44	81
	Reverse BLM proposal (N½ Close S½ Open)	Remainder designated. Natural area
	No night closure	Wilderness (restrict all users)
	Existing roads & trail	National Wildlife Area
	Posted hours of closure	Added to Death Valley National Mon.
Universities, Societies, & Organizations		
Before proposal - 1	3	37
	Close portion for base study	Wilderness Natural Area

EUREKA SAND DUNES
PUBLIC PARTICIPATION ANALYSIS (Continued)

OPEN	COMPROMISE	CLOSE
		Natural area
After Proposal - 10	3	39
	Open S½; Close N½	Ecological Reserve. Close 'til fully studied
	Open dunes & playa, close N. Saline	Designate R & T's to East

TOTAL: 596-270 Open - 56 Compromise - 252 Close - 18 Information Only

Total as of June 1, 1976

APPENDIX E

BLM"S PROGRAM TO ENSURE COMPLIANCE WITH THE ENDANGERED SPECIES ACT OF 1973 (P.L. 93-205)

Introduction

Forty-eight endangered fish, reptiles, birds, and mammals occur in the 11 Western States and Alaska (see Appendix 1). Thirty-three of these occur or are suspected of occurring on national resource lands (NRL). In addition, the Smithsonian Institution has suggested (September, 1974) that 1,432 species of plants be listed as threatened or endangered in the 11 Western States and Alaska. When lists of threatened animals (including mollusks, crustaceans, and insects) and of threatened or endangered plants are actually published, habitats of several hundred such species will require long-term monitoring, enhancement, and general management by the BLM.

This is necessary for compliance with Section 2c and 7 of the Act which state that all Federal departments and agencies shall utilize their authorities in furtherance of the purposes of the Act, and that no Federal agency shall jeopardize threatened or endangered species or their critical habitats.

Furthermore, the BLM is also responsible for its indirect actions which may affect threatened or endangered species adversely (e.g. destruction of aquatic habitat upstream from a population of endangered fish, or the spilling of oil on the Outer Continental Shelf and subsequent destruction of food and/or habitat for endangered marine mammals).

Current thinking concerning critical habitat -- i.e. the land and/or water area, topography, physiography, flora, fauna, climate, and soil, water, and air qualities necessary for the species to complete their life cycles -- is very broad and may result in significant curtailment or restrictions brought by citizens or citizens' groups, as is clearly provided in the Act, are mineral leasing, geothermal leasing, livestock grazing, off-road vehicle use, timber cutting, and vegetative manipulation, such as chaining, seeding, and application of herbicides.

Clearly, the BLM must have an effective endangered species program to ensure compliance with the Act, to prevent further listings, and to bring about delistings of species now recognized as threatened or endangered. The freedom with which economically important, use-oriented programs continue hinges upon the decision of whether to list or not to list a species as threatened. Thus, it is in the best interest of the Bureau to manage wildlife habitat so as to keep species, such as the Tule Elk, Spotted Owl, Desert Tortoise, and Ferruginous Hawk, off the threatened list. The positive ecological publicity that can be derived from such efforts is significant. The BLM has but to do something, so that there is something to tell people, so that they can support the Bureau!

The BLM Endangered Species Program

Three important steps must be taken immediately to develop an effective, image-building BLM program for endangered species:

1. alignment with the nationwide coordination efforts of the Fish and Wildlife Service,
2. maintenance of a supportive role (technologically, financially, with manpower) in State endangered species programs in cooperation with the States, and
3. development of an active, positive Bureau program as called for in the Act and restated by the Secretary of the Interior in his memorandum of October 16, 1974.

Alignment with the FWS

The BLM has been directed to take action, as appropriate, but does not have the lead in either nationwide or State endangered species programs. The Bureau cannot, under current conditions, go it alone. There is need for a measure of responsible cooperation from all sectors.

Thus, BLM must tune in immediately with the Recovery Team-Recovery Plan concept as conceived by the FWS. Guidelines for Recovery Teams and Plans can be obtained from the FWS. It is important that BLM State Directors, with the assistance of their wildlife staffs, work closely with the appropriate Regional Directors of the FWS.

The BLM can assist the FWS in several ways:

1. BLM Fisheries and Wildlife Biologists have the expertise to lead one or more Recovery Teams.
2. The BLM employs a number of potential members of Recovery Teams.
3. The BLM can supply both basic scientific and habitat management consultation to the FWS.
4. The BLM will comment on Recovery Plans for all species occurring on NRL.
5. The BLM will review proposals for listing and delisting of species that occur on NRL.
6. Ultimately, the BLM's most important role will be to implement habitat management as directed within the framework of Recovery Plans.

Supporting State Endangered Species Programs

The States have the authority to implement the 1973 Endangered Species Act as long as they (1) have the legislated authority to deal with threatened or endangered species, (2) can demonstrate an effective program for the conservation of such species, and (3) coordinate their efforts nationally. Some forward-looking States have already taken the initiative with their endangered species and have shown considerable willingness to cooperate with the BLM.

Accordingly, the BLM should support State-coordinated Recovery Teams and Plans in the same ways listed above for BLM-FWS cooperation. At first, as models for other States, the BLM should provide all available staff expertise, manpower, and funding possible in States that have positive threatened and endangered species programs.

Development of an Active BLM Endangered Species Program

The highest priority to the BLM to ensure compliance with the 1973 Act is keeping BLM activities from adversely impacting critical endangered species habitat or else having mitigating measures (such as positive habitat management plans for the affected species) ready for implementation both inside and outside of resource-use impact areas.

Thus, when habitat management to benefit threatened or endangered species on NRL is delayed in the absence of enabling legislation and/or appropriations at the State level (or through the FWS), the BLM must attempt to act for the species' good and for the Bureau's own protection. Such actions should be coordinated as closely as possible with the State involved and should be consistent with Recovery Plans if available.

Manpower

There is need to add to the field men and women with the biological background -- and empathy! -- to deal with the several hundred threatened or endangered species whose habitat BLM will be held responsible for in the future. This is necessary if the BLM is merely going to catch up with the listing process, let alone keep pace with it. The BLM needs more top-notch zoologists, entomologists, and botanists (or the most versatile management experts) for on-the-ground resolution of the most pressing endangered species - BLM conflicts.

This is not to be a police force to check up on the use-oriented BLM divisions; rather it is to be an in-house information service -- a part of building a strong BLM wildlife program that can lessen the adverse effects of coal extraction, oil shale development, grazing allotments, and other BLM actions that may lead to litigation over non-compliance with the 1973 Endangered Species Act.

Manual Revisions

No program can carry forward expediently and effectively without the necessary Manual guidance. A Bureauwide 6840 Manual should be drafted during the last quarter of FY 75 and finalized during FY 76 by WO and DSC staffs in cooperation with key field personnel. In addition, each BLM division should (as requested by Secretary Morton in his October 16, 1974, memorandum) examine all regulations, laws, guidelines, and Manuals currently in effect. Revisions should be undertaken to ensure compliance with the Endangered Species Act of 1973.

Public Affairs

If the BLM is to get maximum benefit from an endangered species program it must also get involved on a cooperative basis in several highly visible projects which border on being "species management." Public awareness programs should focus on species that are synonymous with national resource lands, namely Sonoran Pronghorn, Black-footed Ferret, Utah Prairie Dog, American and Arctic Peregrine Falcons, Warm Springs Pupfish, etc. First, however, with the exception of the pupfish, BLM must do something (or something more) for the species.

Find Black-footed Ferrets in a Utah Prairie Dog town -- or anywhere outside of South Dakota! Set aside Utah Prairie Dog interpretive areas. Reintroduce American Peregrine Falcons along the Snake River outside of the established Birds of Prey Natural Area, but as a logical extension of that extremely successful BLM project. Any of these projects could be developed for less than $50,000 in project money with a net gain of positive accomplishment for wildlife, invaluable goodwill, and public support for BLM.

BLM's Legislated Responsibility

A new program, like new legislation or a new ethic, is difficult to sell. However, in this case, it is not a matter of whether or not the BLM wants to do something positive for endangered species, whether or not the BLM has the manpower and funding to do anything, or whether or not endangered species are a high priority at the State, District, or Resource Area levels. Rather, all Federal agencies have been legislated into being concerned about threatened or endangered species.

There are two options: making the most of public sentiment or fighting that sentiment in court.

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